#	Ch	From Page	From Line	To Page	To Line	Comment
1	30	0	0	0	0	A very good balanced chapter overall (Crabbe, Michael James, University of Bedfordshire)
2	30	0	0	0	0	IOC-UNESCO, 2011. Methodology for the GEF Transboundary Waters Assessment Programme. Volume 6. Methodology for the Assessment of the Open Ocean, UNEP, vi + 71 pp. (Diop, Salif, UNEP - SAB - DEWA)
3	30	0	0	0	0	The vast STGs of the Atlantic, Pacific and Indian oceans are warming in response to increasing air temperatures. \nWarming is projected to continue etc. (Head, Erica, Fisheries and Oceans Canada)
4	30	0	0	0	0	I found this chapter to be in excellent shape. The analyses are thorough yet presented in a concise and clear manner. The tables in particular summarize an enormous number of topics/data. The writing is outstanding. This chapter is a good complement to Chapter 6. There is a good deal of appropriate linkages to Chapter 6, but I found no significant examples of redundancy. There is not the variation in quality I found in some sections of Chapter 6. I have no major recommendations to make and jot down below only a few minor suggestions that may help improve the text a bit and allow correction of a few typographical errors. (Somero , George , Stanford University)
5	30	0	0	0	0	The authors have done a great job in pulling together a coherent chapter about the vast topic of "The Ocean". Although I think it still needs work, the fundemental material is all here. There needs to be a focus on consistency amongst the different section in terms of including "Evidence/Confidence" assessments and also in referencing the primary scientific literature (at present, some sections, largey reference other Reports/Chapters of AR5). (Lough, Janice, Australian Institute of Marine Science)
6	30	0	0	0	0	This Chapter is well written and easy to read. (AUSTRALIA)
7	30	0	0	0	0	It needs to be made clearer exactly what oceans information chapter 6 and chapter 30 cover and how they differ from each other. There seems to be dulplicated information between the chapters. Both chapters could benefit The report could benefit from clarifying why two chapters on oceans is required. (AUSTRALIA)
8	30	0	0	0	0	Different wording has been used to express uncertainty. E.g:, “very high confidence” (page 3, line 18),” robust evidence, high agreement” (page 3, line 28), “high confidence” (page 3, line 31), “high confidence, $p < 0.01$” (page 3, line 38,39), “medium confidence”, “medium evidence, medium agreement” (page 4, line 21), “limited evidence, medium agreement” (page 4, line 38), “high confidence, $p<0.05$” (page 4, line 34). Furthermore, the terms “virtually certain” (page 3, line 6), “likely” (page 4, line 25) and “very likely” (page 4, line 45) are frequently used. \nIt is unclear how and why these different uncertainties have been assigned.The quality of the chapter might be substantially improved by a reduction in the numbers of uncertainty descriptors together with a brief description.\nI also question whether statements that are assigned “limited evidence” should be part of the executive summary as this term sounds like insufficient evidence. E.g. (page 5, Line 36-37) “Projected change to ocean ecosystems as a result of ocean warming and acidification will reduce access to food, and increase poverty and disease in many countries”. It is not obvious which studies referred to in the chapter that this statement is based upon. Furthermore, the validity of the statement disappears by the uncertainty that has been assigned to it in the following parenthesis: medium agreement, limited evidence. Why include the strong statement in the first place? And what does “agreement” refers to? (Aksnes, Dag Lorents, University of Bergen)
9	30	0	0	0	0	The word “impact” is used excessively throughout Chapter 30 in a way that tends to diffuse the message. E.g. (page 5, line 37-38): “Key fisheries throughout the world are being impacted by climate change, through direct physiological and ecological impacts.” Rather than providing an answer on how key fisheries have been affected, two new questions are implied by the statement: How is physiology affected and how is ecology affected by climate change. I believe the text can be significantly improved by substituting “impacts” with the specific effects and mechanisms that the authors have in mind. (Aksnes, Dag Lorents, University of Bergen)

#	Ch	From Page	From Line	To Page	To Line	Comment
10	30	0	0	0	0	It is not always obvious whether statements in the text, like the one I have already commented (page 57, line 9-11), are based on actual observations or rather reflect mechanisms (hypotheses) that the authors find plausible. Another example of an apparent mixture of observational evidence and mechanisms that are considered plausible are found on line 34-38 page 4: "Significant warming over this period has resulted in increased water column stratification and mixed layer depth. This has reduced the vertical transport of nutrients into the upper layers of the Ocean and has reduced primary production by phytoplankton in these vast areas..." Which studies have actually demonstrated reduced transport of nutrients to the euphotic zone and decreased primary production of the Ocean?\nIn Chapter 6 there appears to be a better distinction between direct observational evidence from published papers and plausible mechanisms that are used by the authors. This distinctino appears to be partly facilitated by subchapter "6.5. Future projections of climate change impacts through modeling approaches". I think chapter 30 also will benefit from a structure where hypothetical evidence and future projections are more clearly distinguished from direct observational evidence reported in published studies. (Aksnes, Dag Lorents, University of Bergen)
11	30	0	0	0	0	There is overlap between Chapter 30 "The Ocean" and Chapter 6 "Ocean Systems". This is not surprising as it is not straightforward to make a strict border between these chapters. On the issue of climate change – stratification – nutrients – primary production, but also elsewhere, a check for consistency with Chapter 6 is needed. (Aksnes, Dag Lorents, University of Bergen)
12	30	0	0	0	0	References to chapter 6 should be checked and updated as the structure of chapter 6 has been changed and simplified. (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)
13	30	0	0	0	0	The draft mostly covered the "Open Ocean" characteristics and was well written. However, the facts already emerged and those projected are still mixtured in some sections. More clear separation of thoes items are helpful for readers. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
14	30	0	0	0	0	Nonlinearlity of the biological response is partly described. Linear regression analysis is very dangerous for biological data. This fact must be expressed in the beggining of the discussion. Please add more discussion on the nonlinearlity; e.g. critical temperature, distinction of spawning area, match/mismatch between prey and predator, migration pattern change, etc. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
15	30	0	0	0	0	Finally, regarding chapter 30, I could not find any connection with chapter 6. These two chapters are closely related. I hope good organization between them. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
16	30	0	0	0	0	General Comments – This is a very nicely put together chapter on which I have few comments. There is a need to disentangle the effects of fishing pressure from climate. Genner et al., 2010 did this with a 100 year data set from the Western English Channel. We showed that small fish, most of which were non-commercial tracked climate change, whilst abundance of larger fish was largely driven by fishing pressure. This took further Genner et al., 2004 which concentrated on temperature alone. Simpson et al 2011 took a wider view of shelf fisheries. This work should also be mentioned. \nGenner MJ, Sims DW, Wearmouth VJ, Southall EJ, Southward AJ, Henderson PA, Hawkins SJ. 2004. Regional climatic warming drives long-term community changes of British marine fish. Proceedings of the Royal Society of London, Biological Sciences 271: 655-661.\n\nGenner MJ, Sims DW, Southward AJ, Budd GC, Masterson P, Mchugh M, Rendle P, Southall EJ, Wearmouth VJ, Hawkins SJ. 2010. Body size-dependent responses of a marine fish assemblage to climate change and fishing over a century-long scale. Global Change Biology 16: 517-527.\n\nSimpson SD, Jennings S, Johnson MP, Blanchard JL, Schon PJ, Sims DW, Genner MJ. 2011. Continental shelf-wide response of a fish assemblage to rapid warming of the sea. Current Biology 21 (18): 1565-1570.\n (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)

#	Ch	From Page	From Line	To Page	To Line	Comment
17	30	0	0	0	0	The chapter is well written and well organized. However, there is rather extensive use of new (unpublished) figures and some new analyses. It is positive that the figures and analyses are based on well-documented data sets, but it is still new analyses which has not been through an scientific peer-review before. For excample figures 30-10, 30-13 and 30-14 seems to contain substantial new analyses. Due to the different scientific relability of already peer-review material and new analyses, this should be adressed in the beginning of the capter (e.g., in the Executive summary). (Ingvaldsen, Randi, Institute of Marine Research)
18	30	0	0	0	0	Chapters 6 and 30 must be coordinated! There is too much overlap. This being said, I find Chapter 30 generally well written and the structuring into different regions very useful. However, the first parts of the chapter are partly a repetition of information already fully given in Chapter 6. E.g., 30.3 and 6.1.1 address the same general issues. I have a problem with "Open Oceans" (the title given in the Contents), and even more so "The Ocean" (the title given in the chapter) being classified as a region. The Oceans cover, as written in page 6, line 43, 71 % of the earth's surface! In some way the principle difference between chapters 6 and 30 must be made clearer, as must the classification of the oceans as a region. This may already have been done in Ch. 1, which I must admit I haven't read, but should also be dealt with early in chapter 30 (Chapter 6 now refers briefly to Chapter 30, Chapter 30 refers to sections of Ch 6 in the excellent Executive Summary, but not in the Introduction). (Ottersen, Geir, Institute of Marine Research)
19	30	0	0	0	0	In general, it seems like there is significant repetition between Chapter 6 and this chapter. The distinction between chapters is not really made clear in the introduction. Suggest clarifying how they differ in terms of focus. It may be possible to cut back further on some of the discussion on the physical and chemical impacts on oceans by referring the reader to Chapter 6. (CANADA)
20	30	0	0	0	0	Authors appear to be using confidence which is a qualitative measure rather than certainty/likelyhood. Whenever possible use certianty/likelyhood (UNITED STATES OF AMERICA)
21	30	0	0	0	0	Both MOC and AMOC are used early in chapter. Is this deliberate, to distinguish global vs Atlantic? (UNITED STATES OF AMERICA)
22	30	0	0	0	0	Can the first time RCP is spelled out it be given a simple definition? The name is not intuitive. The representative concentration pathways, or greenhouse gas concentration trajectories. This is in other chapters and is a fundemental IPCC definition, but for utility of stand alone chapters, repeating the defintion would be helpful. (UNITED STATES OF AMERICA)
23	30	0	0	0	0	Executive Summary - The introductory paragraph states that the chapter focuses on 8 regional divisions but the first 4 ES conclusions, and several others are about the whole ocean system, overlapping Ch 6. Consider having ES summaries for the 8 regions as stated. (UNITED STATES OF AMERICA)
24	30	0	0	0	0	It is recommended that Executive Summary statements be limited to the regional differences in climate change impacts as is summarized in Figure 30-15. (UNITED STATES OF AMERICA)
25	30	0	0	0	0	It is surprising that there are not more studies cited using sateliite remote sensing data and the long time series analysis of changes in coccolithophorids, calcite, POC, etc. by e.g. Barney Balch. It is suggested in the text that the remotely sensed time series of biological data is not long enough to show sustained responses of biology/ecology/chemistry to climate shifts, but SeaWiFS has a nearly 13 year time series, MODIS-Aqua nearly 12 years, MERIS about 13 years, and this is longer than some of the ship-based collection records cited in the published studies. Also, remotely sensed data can show truly global trends, which could be useful in this document. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
26	30	0	0	0	0	Most of the chapter discusses fish and other faunal patterns, and SST, from recent decades. In many cases attribution of causality to these patterns is made. There is virtually no discussion of longer term, late Holocene ocean circulation or SST and its causes even though there are dozens of papers from the Nordic Seas and North Atlantic using sediment cores and many SST proxies [incluing faunal, phytoplankton, and geochemical proxies]. Paleoceanography and past faunal/floral patterns are an essential part of detection and attribution of human-induced changes. Thus the chapter seems to send a message that prior to human record keeping and the Anthropocene, ocean circulation, SST, faunal assemblages and phytoplankton activity were somehow stable which we know is not the case. It would be valuable to add a section on Holocene paleo-records, and acknowledge the challenge of attribution of cause given known centennial and multi-decadal variability. At least, the chapter should make appropriate references to ocean observations and paleo chapters of WG1. Additionally, perhaps this historic context could be valuably presented in an FAQ. (UNITED STATES OF AMERICA)
27	30	0	0	0	0	PDO, AMO, NAO & other internal modes of climate variability are discussed in many places in the chapter. It is well known that they significantly influence ocean biota etc. These modes of variability are frequently mentioned as a major source of uncertainty, but they are summarized in a single line on p. 57. It would be useful to put a table and introductory paragraph early in the chapter discussing these modes, their dominant timescales and areas and seasons of greatest impact [ie teleconnections]. These are WG1 concepts that will not necessarily be known to the typical WG2 reader. (UNITED STATES OF AMERICA)
28	30	0	0	0	0	Sometimes units have dots (mmol.kg-1 and sometimes no dots; sometimes oxygen is spellled out and sometimes shown as O2 even in same sentence (e.g., p 18, line 34-35). (UNITED STATES OF AMERICA)
29	30	0	0	0	0	Suggest that the Blue Carbon concept/write up p.54 be moved to "Emerging Issues" section p.56 (UNITED STATES OF AMERICA)
30	30	0	0	0	0	The 8 regions are not addressed until Page 20. Please consider condensing the early introductory material that is very repetitive with Chapter 6. (UNITED STATES OF AMERICA)
31	30	0	0	0	0	The authors are encouraged to reconsider the balance of discussion given to scientific topical areas. The "Oceans" chapter seems to focus very heavily on ocean acidification, some corals, and fisheries. While these are important areas, only a paragraph is given to sea level, heat budget, etc. The report is light on ocean physics, and much of the biogeochemistry (carbon cycling, nitrogen, major nutrients, etc.) has been excluded. Southern Hemisphere only gets two paragraphs. If the authors feel this is outside the scope of this chapter, they should confer with Ch 6 authors to see where these issues can be most appropriately addressed. Additionally, beyond the intra-WG2 coordination, references to the WG1 report would be valuable, as well. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
32	30	0	0	0	0	The chapter is missing a discussion of the impact of climate change on marine mammals. The discussion should include impacts on marine mammals directly (including increased die off in disease) as well as impacts from changes in their food supply and habitats, as well as from climate-related changes in commercial fishing, as well as native and cultural practices. This could be addressed in the marine organism response, social impacts and regional sections. The regional sections, especially the Arctic should be well coordinated with the Arctic chapter. Suggested references include: Sue E. Moore and Henry P. Huntington 2008. ARCTIC MARINE MAMMALS AND CLIMATE CHANGE: IMPACTS AND RESILIENCE. Ecological Applications 18:S157–S165. http://dx.doi.org/10.1890/06-0571.1; Ashjian, C.J.et al 2010. Climate variability, oceanography, bowhead whale distribution and Inupiat subsistence whaling near Barrow, Alaska. Arctic 63(2): 179-194; Grebmeier, et al. 2010. Biological response to recent Pacific Arctic sea ice retreats. EOS 91(18): 161-162.; Kovacs, K.M., et al 2010. Impacts of changing sea ice conditions on Arctic Marine Mammals. Marine Biodiversity: 51-65.; Moore, S.E. 2010. Whales facing climate change in the Pacific Arctic. Whalewatcher 39(2): 7-11.; Moore, S.E., et al.2010. Bowhead whale distribution and feeding near Barrow, AK in late summer 2005-06. Arctic 63(2): 195-205; Learmonth et al 2006 ; Slenning 2010;K. Burek, DM Lavigne, CT Tynan, MP Simmonds (review)\n (UNITED STATES OF AMERICA)
33	30	0	0	0	0	The chapter is missing a discussion of the impact of climate change on marine mammals. The discussion should include impacts on marine mammals directly (including increased die off in disease) as well as impacts from changes in their food supply and habitats, as well as from climate-related changes in commercial fishing, as well as native and cultural practices. This could be addressed in the marine organism response, social impacts and regional sections. The regional sections, especially the Arctic should be well coordinated with the Arctic chapter. Suggested references include: Sue E. Moore and Henry P. Huntington 2008. ARCTIC MARINE MAMMALS AND CLIMATE CHANGE: IMPACTS AND RESILIENCE. Ecological Applications 18:S157–S165. http://dx.doi.org/10.1890/06-0571.1; Ashjian, C.J.et al 2010. Climate variability, oceanography, bowhead whale distribution and Inupiat subsistence whaling near Barrow, Alaska. Arctic 63(2): 179-194; Grebmeier, et al. 2010. Biological response to recent Pacific Arctic sea ice retreats. EOS 91(18): 161-162.; Kovacs, K.M., et al 2010. Impacts of changing sea ice conditions on Arctic Marine Mammals. Marine Biodiversity: 51-65.; Moore, S.E. 2010. Whales facing climate change in the Pacific Arctic. Whalewatcher 39(2): 7-11.; Moore, S.E., et al.2010. Bowhead whale distribution and feeding near Barrow, AK in late summer 2005-06. Arctic 63(2): 195-205; Learmonth et al 2006 ; Slenning 2010;K. Burek, DM Lavigne, CT Tynan, MP Simmonds (review). (UNITED STATES OF AMERICA)
34	30	0	0	0	0	The chapter lacks adequate discussion on the connection between climate change and marine mammal species. There is a body of literature on this topic (e.g., the work of Sue Moore) (UNITED STATES OF AMERICA)
35	30	0	0	0	0	The Executive Summary seems extremely long. Suggest that it be condensed. (UNITED STATES OF AMERICA)
36	30	0	0	0	0	The repetition between chapters 30 and 6 also carries over into the executive summaries of both chapters. The first two pages of the Executive Summary is information that should actually be included in chapter 6 with the exception of lines 32-41 on page 4. In some cases, where material is repetitive, the statements seem contradictory, and some of these have been pointed out in individual review comments. Since the executive summaries may be the only sections that are read by many readers, it is imperative that the space and content be used efficiently to relay the most important issues. It is also recommended that the authors of chapters 30 and 6 review both of these chapters, and relevant sections of the WGI document to minimize unnecessary redundancy, optimize cross referencing and insure consistency of both factual information and use of confidence and likelihood statements. (UNITED STATES OF AMERICA)
37	30	0	0	0	0	The topic and concluding sentences in many areas of the chapter are vague and feel "tacked on" just for transition purposes. Given that space is a consideration, all of the text should be important and well-considered. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
38	30	0	0	0	0	The use of confidence and likelihood statements is inconsistent within this chapter and between chapter 30 and 6. There are some sections in which confidence or likelihood statements are included after almost every sentence, and in other areas there are entire chapter sections without a single confidence statement. In some cases there is evidence of statistical confidence (for example p values are listed) however a confidence statement is applied instead of a likelihood statement. In general, for many of the statements including information on chemical concentrations or physical properties of ocean systems, likelihood statements can and should be applied; for many of the biological observations, it is more difficult to apply likelihood statements, and in these cases, confidence statements should be used. There are also instances in which the wrong language is used in a confidence statement (e.g. moderate confidence instead of medium confidence, etc.). (UNITED STATES OF AMERICA)
39	30	0	0	0	0	There are many repetitive ideas in Chapter 30. One is the notion that warming will increase stratification, decrease nutrient upwelling, and decrease primary productivity. Another is that warming temperatures will increase microbrial respiration and low-oxygen conditions. These universal concepts would be best addressed once and not repeated in every section and explained with different citations every time they occur. (UNITED STATES OF AMERICA)
40	30	0	0	0	0	There are periodic uses of "moderate confidence" - example on p.45. This does not appear to be consistent with IPCC-approved terminology. (UNITED STATES OF AMERICA)
41	30	0	0	0	0	There is a bewildering array of jargon and acronyms in this chapter. For the sake of the non-expert, the authors are strongly encouraged to simplify their discussions. (UNITED STATES OF AMERICA)
42	30	0	0	0	0	There is a tendency throughout the chapter to make statements of speculation rather than to focus on just facts, and as such, the text seems a bit "jargony" in places. The authors should take care in addressing certainty when discussing topics where outcomes or information is unknown, especially in predicting future conditions. Unqualified, speculative statements are potentialy problemmatic and should be avoided where possible. (UNITED STATES OF AMERICA)
43	30	0	0	0	0	There is considerable repetition of material between the Chapters 30 and 6. It is understood that these chapters should be readable as stand-alone. However, clear statements should be made in the introductions on the objective of each chapter, the need to review some fundamental concepts for an understanding of the chapter material, and the differences between chapters 6 and 30. The objective of chapter 30 is to focus on regional impacts. However, the first 20 pages of the chapter is a reiteration of information that should be in chapter 6. Discussion of regional impacts does not start until section 30.5 on page 20. It is suggested that the information in sections up to 30.4 be merged with Chapter 6 to reduce repetition and streamline the focus of Chapter 30. (UNITED STATES OF AMERICA)
44	30	0	0	0	0	There is far too much overlap with Chapter 6 and both chapters are long. (UNITED STATES OF AMERICA)
45	30	0	0	0	0	This chapter seems to make irregular use of uncertainty estimates as per the IPCC system. Some paragraphs have an estimate after almost every sentence, and then some pages have nothing. More consistency is needed in the number of estimates given and the types of information that estimates are used on. For example, passages that review the literature have either citations everywhere or nowhere. (UNITED STATES OF AMERICA)
46	30	0	0	0	0	To ensure consistency, chapter 30 authors should review chapter 6 and vice versa. (UNITED STATES OF AMERICA)
47	30	0	0	0	0	We believe that Blue Carbon should be removed from p 47 and p. 54 and included in Emerging Themes (UNITED STATES OF AMERICA)
48	30	0	0	0	0	While Chapter 30 intro mentions Chs 3 and 10, for differentiation, it does not mention Ch 6. This needs attention: to explain the role of Ch 6 relative to Ch 30. (UNITED STATES OF AMERICA)
49	30	0	0	0	0	The authors have answered and addressed my previous questions from the first round of review. (Caffrey, Maria, National Park Service and University of Colorado, Boulder)

#	Ch	From Page	From Line	To Page	To Line	Comment
50	30	0	0	0	0	This chapter has improved markedly since the FOD, but there are still places where it seems confused regarding what exactly is the question we are trying to answer. Is it (a) “Does climate affect marine ecosystems?” or (b) “Does specifically anthropogenically driven climate change affect ecosystems in ways that can be detected against the background of natural variability?” In a number of cases the stated levels of confidence seem more appropriate to (a) than (b), or the reference frame seems to shift back and forth between (a) and (b) when evidence to assign a high confidence level to (b) is lacking. I think this chapter still needs some clarification of what its mandate is and what is the overarching the question it is trying to answer, particularly in the Executive Summary.\n\nThere are a number of places where I think the stated confidence level is too high or too low. In the case of ocean acidification, I would say it is virtually certain that pH has declined, that it will continue to do so, and that this trend is caused by anthropogenic CO2. On the other hand, a variety of climate and ecosystem impacts are given confidence higher than I would say is warranted, and I genuinely can not tell whether this is intended to be an attribution to anthropogenic forcing, or simply a statement that these phenomena are affected by 'climate', in a broad sense that includes both climate variability and anthropogenic climate change. This is what I meant by shifting of reference frame above.\n\nThere is still some conflation of climate and other anthropogenic impacts (e.g. top p.18). On 18/9-12 "climate change at decadal time scales" is invoked. I can not tell what is meant by this. Trends at this time scale involve diverse regional effects and do not have single direction or cause globally. 57/32-34 conflates variability and change, and sheds little light on what is known about how climate variability or its impacts will change in the future. (Christian, James, Government of Canada)
51	30	0	0	0	0	References to climate modes as "cycles" have been scaled back but not eliminated. The paragraph at top p. 19 is quite good but I can not make sense of the reference to "climate oscillation" in the final sentence. 23/1-20 implies that AMV is a cyclic process. 23/29 refers to the 'periodicities' of the PDO. (Christian, James, Government of Canada)
52	30	0	0	0	0	I think it is a misconception to state that temperature effects on respiration will result in a general decline in subsurface oxygen concentrations. Temperature controls the remineralization rate, but organic matter supply controls the net change (since almost all of the organic matter supply is eventually remineralized). It is possible that an increasing rate will result in localized decline in O2 in certain depth strata (because organic particles would otherwise have sunk to greater depths), but the current text presents an effect of remineralization rate on O2 concentration as being much more general than it is. I don't understand how declining primary production can generate a general increase in subsurface remineralization (e.g., 57/11). I don't see why it is necessary to cite terrestrial analogues for a very general 'ballpark' estimate of the Q10 of microbial communities (45/43); there are plenty of marine data. Brown et al 2004 is not a particularly appropriate reference for what is a basic fact of biochemistry (46/1). (Christian, James, Government of Canada)
53	30	0	0	0	0	It seems that this chapter (especially the executive summary) repeats a lot of material in chapter 6. It is clear that chapter 6 and 30 were written by a completely different set of authors, with very little communication during the writing process. There are very few cross references between chapters and there are many worrying inconsistencies in the evidence and certainty/confidence assessments that should have been cross-checked. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
54	30	0	0	0	0	This chapter frequently uses "very likely" (throughout the chapter) based on flimsy and anecdotal information. It does not use a systematic nomenclature for uncertainty or consensus (unlike chapter 6) and hence it reads as if it is an opinion pieces rather than a rigorous assessment . It could be VERY VULNERABLE TO EXTERNAL CHALLENGE unless it is tightened up considerably. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
55	30	0	0	0	0	There are some missing/ incorrect citations in the chapter. These discrepancies have been highlighted in the ref check document for chapter 30 and is available in the supporting material web page. Chapter team may wish to rectify these errors before starting to work on SOD revisions and FGD preparation. (Chatterjee, Monalisa, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
56	30	0	0	0	0	Robinson projection is the recommended projection for global maps. Please ensure this projection is used wherever possible to have a consistent presentation across the volume. (Estrada, Yuka, IPCC WGII TSU)
57	30	0	0	0	0	1) Overall -- This chapter team has developed a very robust 2nd-order draft. In the final draft, the chapter team is encouraged to continue its prioritization of effective figures, rigorous assessment, high specificity, and clear writing. (Mach, Katharine, IPCC WGII TSU)
58	30	0	0	0	0	2) Coordination across Working Group II -- In developing the final draft of the chapter, the author team should continue to ensure coordinated assessment, both in the chapter text and at the level of key findings. Such coordination is relevant across many of the sectoral and regional chapters, but especially across chapters 5, 6, and 30. Where cross-references are made to other chapters, they should preferably cross-referenced specific sections and/or assessment findings of the chapters, continuing to ensure that overlaps are reduced and assessment harmonized. (Mach, Katharine, IPCC WGII TSU)
59	30	0	0	0	0	3) Harmonization with the Working Group I contribution to the AR5 -- In developing the final draft, the chapter team should also ensure all cross-references to the Working Group I contribution are updated, with discussion of climate, climate change, and climate extremes referencing the assessment findings in that volume. Where cross-references are made, wherever possible and appropriate they should specify the specific relevant sections of Working Group I chapters, instead of generic references to whole chapters. (Mach, Katharine, IPCC WGII TSU)
60	30	0	0	0	0	4) Shortening and tightening the chapter -- The chapter team is strongly encouraged to shorten the text of the chapter as much as possible, ideally by 20 pages. Material that overlaps with chapter 6 and working group 1 should be reduced especially, with concise cross-referencing used here. The effectiveness of the chapter will be much greater if it is substantially shorter. (Mach, Katharine, IPCC WGII TSU)
61	30	0	0	0	0	5) Presentation of uncertainty language within parentheses -- As much as possible, the chapter team should present calibrated uncertainty language within parentheses at the end of sentences. Such placement maximizes the directness and clarity of statements. Wherever possible, formulations such as "there is high confidence that" should be nixed and replaced by "(high confidence)" at the end of the sentence. (Mach, Katharine, IPCC WGII TSU)
62	30	0	0	0	0	6) Report release -- The chapter team should be aware that the final drafts of the chapters will be posted publicly at the time of the SPM approval, before final copyediting has occurred. Thus, the chapter team is encouraged to continue its careful attention to refined syntax and perfected referencing. (Mach, Katharine, IPCC WGII TSU)
63	30	0	0	0	0	7) Characterization of future risks -- In characterizing future risks for the oceans, to the degree appropriate the chapter team should indicate the extent to which risks (or key risks) can be reduced through mitigation, adaptation, and other responses. In discussing evolutionary adaptation or ecological shifts versus human responses and adaptation affecting the oceans, clarity should be ensured. If possible, the chapter team should communicate how risks may increase as the level of climate change increases or, potentially, the relative importance of changes in mean conditions, as compared to changes in extreme events, as compared to potential non-linear changes associated with biome shifts or tipping points. Building from this, how much can risks be reduced through adaptation or other management approaches, in the near-term and the long-term? How are factors or stressors that multiply risks relevant in this context? As supported by its assessment of the literature, the author team should consider communicating risks for the era of climate responsibility (the next few decades, for which projected temperatures do not vary substantially across socioeconomic/climate scenarios) and for the era of climate options (the 2nd half of the 21st century and beyond). As would be helpful to the chapter, the framing of table SPM.4 could be considered in characterization of future risks, along with the key and emergent risk typology of chapter 19. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
64	30	0	0	0	0	8) Informing the summary products -- To further support robust and insightful summary products for the report, the chapter team is encouraged to maximize nuance as well as traceability in its key findings, continuing to use calibrated uncertainty language effectively. In addition to nuanced characterization of future risks (see the previous comment), the chapter team is encouraged to consider themes emerging across chapters, indicating for example how extreme events pose risks for the oceans, how limits to adaptation may be relevant in the context of this chapter, and how interactions among mitigation and adaptation may occur. (Mach, Katharine, IPCC WGII TSU)
65	30	0	0	0	0	9) Likelihood terms versus levels of confidence -- Wherever likelihood terms are used, the chapter team should ensure their assignment stems from a probabilistic basis in the underlying evidence. If such a basis is not available, presentation of a level of confidence for the conclusion is more appropriate. (Mach, Katharine, IPCC WGII TSU)
66	30	0	0	0	0	10) Care with extrapolation -- The chapter team should exercise care when making future-oriented statements based on observed changes. In some places, the saying "correlation does not equal causation" came to mind. Additionally, any such extrapolation should be robustly supported by the analyses in the underlying literature. (Mach, Katharine, IPCC WGII TSU)
67	30	0	0	0	0	11) Scientific characterization of risk -- As a core part of its mandate, the chapter team should assess risks for the oceans, from a scientific and technical perspective. In some places in the chapter, the author team may be too much asserting value judgments about those risks, going beyond the expert judgments that are part of its mandate. (Mach, Katharine, IPCC WGII TSU)
68	30	0	0	0	0	12) Acknowledging uncertainties -- In some places where the chapter team provides best estimates for various projected variables, it would be helpful to further indicate that these are estimates with uncertainties, not exactly determined values. This applies for example in discussion in the chapter text of value summarized in table 30-4. (Mach, Katharine, IPCC WGII TSU)
69	30	0	0	0	0	13) Conventions for calibrated uncertainty language -- All calibrated uncertainty language used in the chapter should be italicized for clarity. Casual usage of the reserved likelihood terms should be avoided. I have tried to flag relevant instances within the chapter. (Mach, Katharine, IPCC WGII TSU)
70	30	0	0	0	0	GENERAL COMMENTS: I congratulate the author team for all their work on the SOD. When considering the suite of review comments, please look for opportunities to continue to hone and focus the text in revision even further, reducing length wherever possible. Please see my detailed comments for suggestions related to specificity of ES findings, traceable accounts, and specific clarifications. In addition, where likelihood terms are used ("likely," "very likely," etc.), it is also not always clear whether they are intended as calibrated language or not--please carefully check this and avoid casual usage. (Mastrandrea, Michael, IPCC WGII TSU)
71	30	0	0	0	0	SUMMARY PRODUCTS: In preparing the final draft of your chapter and particularly your executive summary, please consider the ways in which your chapter material has been incorporated into the draft SPM and TS. For Chapter 30, this includes presentation of observed impacts and vulnerabilities in section A.i and sectoral and regional risks in section C.i, as well as related figures and tables. Are there opportunities for presenting chapter findings and material in a way that further supports broad themes highlighted in the summary products and that facilitates additional cross-chapter synthesis in specific findings or figures/tables? Do the existing summary product drafts suggest additional coordination that should occur between Chapter 30 and other chapters at LAM4? (Mastrandrea, Michael, IPCC WGII TSU)
72	30	0	0	0	0	The notation p< is used in this chapter several times. What does it mean ? (Petit, Michel , CGIET rue de Bercy)
73	30	1	0	0	0	Comments restricted mainly to summary, 30.4 and 30.5 (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
74	30	1	1	1	1	The tile" The Ocean" is hanging. Let the title capture the sprit of the underlying text in the entire document. In otherwords, the title always prepares the reader what he expects in the text of the document (KENYA)

#	Ch	From Page	From Line	To Page	To Line	Comment
75	30	1	1	1	1	the original chapter title was "Open Oceans" (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)
76	30	3	0	4	0	In general, much of the information in Ch. 30 ES is repetitive of the Ch. 6 ES, especially on pages 3 and 4. Ch. 30 ES should focus on statements regarding region specific climate change impacts and observations. The ES statements on pages 5 and 6 are good examples of the type of information that should be included. Figure 30-15 is an excellent summary of the primary points in this chapter and could be used as a guide to restructure the Ch. 30 ES to remove repetitious materials, focus on the intended objective of the Chapter and shorten the document's overall length. (UNITED STATES OF AMERICA)
77	30	3	1	0	0	Length of the Executive Summary -- The chapter team should reduce the length of the executive summary to 2.5 pages as the maximum length. (Mach, Katharine, IPCC WGII TSU)
78	30	3	1	0	0	Characterizing Future Risks in the Executive Summary -- As much as possible and as a core way to reduce length and increase focus , the chapter team should specify risks and key risk for ocean regions and the oceans overall. The chapter team, as possible, should indicate the degree to which future risks change or increase with increasing levels of climate change. Which risks emerge in the near-term, and which emerge in the long-term? What is the potential for reducing risks through adaptation and mitigation? (Mach, Katharine, IPCC WGII TSU)
79	30	3	1	0	0	Use of Likelihood Terms -- Wherever likelihood terms are used within the executive summary, the chapter team should ensure a probabilistic basis is available for their assignment. If such basis is not available, presentation of a level of confidence for the conclusion is more appropriate. (Mach, Katharine, IPCC WGII TSU)
80	30	3	1	0	0	Executive Summary: Please continue to refine the focus and clarity of the executive summary as you revise the chapter--it is currently too long. In addition, to the extent possible as supported by the literature, please emphasize what risks are projected to emerge over different time horizons (e.g., mid-century vs. end-of-century), as well as the potential or lack of potential for mitigation and adaptation to reduce them. Please also ensure clear line of sight to underlying chapter sections and full support for all findings in chapter 30. It is appropriate to include cross-references to other chapters and Working Group I in the chapter text, but not in the executive summary in most cases--I would recommend moving all references to chapter 6 to the chapter text, making it clear how they are relevant to the findings of chapter 30. Right now, some paragraphs present findings that are not fully support in chapter 30--I have pointed these out in specific comments. I have also noted places where further clarity in terms of traceability is needed in my specific comments. (Mastrandrea, Michael, IPCC WGII TSU)
81	30	3	1	6	36	Cut the ES reasonably and make it as concise as possible. (Duan, Juqi, National Climate Center, Chinese Meteorological Administration)
82	30	3	1	6	36	The Executive Summary is too lengthy, it should be shorten. (PAN, Jiahua, Chinese Academy of Social Sciences)
83	30	3	3	3	20	The intro to the Executive Summary is well written and useful. The Executive Summary itself is very good, providing the main points in easy to understand language. (AUSTRALIA)
84	30	3	6	3	18	I would recommend against presenting findings in this introductory text, given that no line of sight is included. Present the findings after the introduction, if retained. (Mastrandrea, Michael, IPCC WGII TSU)
85	30	3	7	3	7	Change "ocean" to "open ocean". This makes the phrase "virtually certain" true. In the coastal ocean it is not certain that pH is changing from anthropogenic activities. (UNITED STATES OF AMERICA)
86	30	3	10	3	13	Executive Summary defines Polar Seas by the presence of sea ice, and notes these are dealt with in Ch 28. However, Ch 28 (pg 5) defines the Antarctic polar region as the continent and surrounding Southern Ocean south of the polar front (generally around 58 degrees south). Suggest the two chapters adopt a more consistent aprpoach, or that Executive Summary (Ch 30) more clearly note that the Southern Ocean (south of the polar front) will be considered in Ch 28. (AUSTRALIA)
87	30	3	12	3	12	The Deep Ocean is commonly defined as > 2000 m, not greater than 1000 m. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
88	30	3	14	3	14	Casual usage of "unlikely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
89	30	3	22	3	22	Changed significantly over the past 60 years relative to what? before 60 years ago? Or since observations have been made? Or within the period of observations? A qualification is necessary here to clarify the statement. (UNITED STATES OF AMERICA)
90	30	3	22	3	22	Given the use of "significant" in statistical context, it may be clearest to avoid "significantly" here. (Mach, Katharine, IPCC WGII TSU)
91	30	3	22	3	22	Please clarify what is meant by significantly here. (Mastrandrea, Michael, IPCC WGII TSU)
92	30	3	24	3	27	This statement is not well supported in the cited sections of chapter 30, although section 30.5 provides further discussion of this material. Please consider the appropriate line of sight to include during revisions. (Mastrandrea, Michael, IPCC WGII TSU)
93	30	3	25	3	27	This sentence implies that long-term variability (which may be natural) could be bad, that's likely not the intent. Suggest editing to "Temperatures in many sub-regions are influenced by both long-term variability.... AMO) and anthropogenic climate change...." (UNITED STATES OF AMERICA)
94	30	3	28	3	28	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
95	30	3	30	3	31	...changes in wind speed... may be too general here, given that it refers to increased thermal stratification. Recommend changing 'changes' to increases' or making the subsequent comment on stratification more general. (UNITED STATES OF AMERICA)
96	30	3	31	3	34	unprecedented in millions of years seems vague. Can you specify? (UNITED STATES OF AMERICA)
97	30	3	31	3	34	The language in these statements (i.e., that increased uptake of atmospheric CO2 has caused a fundamental change in ocean chemistry; and that the state and rate of change is unprecedented in millions of years) seems contradictory with the statement in Ch. 6, p5, L5-6 that changes in water chemistry have been limited from pre-industrial times and today. It is suggested that these types of broad statements regarding ocean conditions be limited to the Chapter 6 Executive Summary, while Chapter 30 should retain focus on regional observations and trends. (UNITED STATES OF AMERICA)
98	30	3	32	3	33	rather virtually certain (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
99	30	3	32	3	33	Why use "Very High Confidence" here when WG1 Ch3 uses "very likely"? (UNITED STATES OF AMERICA)
100	30	3	34	3	34	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
101	30	3	37	3	38	The bold introductory sentence should be divided into two parts : the first one reletive to the future evolution in the long run should be kept in bold, but the end of the sentence from "although", about the next 20 years, is not a summary of the paragraph and should be typed using normal characters. This would permit to clarify whether the qualification high confidence applies to one or the other or both statements. What is the meaning of p< 0,01 ? (Petit, Michel , CGIET rue de Bercy)
102	30	3	37	3	48	The information in the Executive Summary statements seems more suited for Ch. 6 ES. Recommend focusing these types of broad statements regarding ocean impacts to Ch. 6 ES. (UNITED STATES OF AMERICA)
103	30	3	37	3	48	The temperature is not rising and the pH changes metrely alter variability with no evidence of harm (Gray, Vincent, Climate Consultant)
104	30	3	38	3	38	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
105	30	3	38	3	39	high confidence, p<0.01 Is this approach of combining confidence and likelihood statements consistent with IPCC guidance? (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
106	30	3	39	3	39	The inclusion of a p-value here is confusing, what is the intent? Is it meant as a counterpart to the calibrated confidence statement, and in what context? I would recommend deletion here and including explanation in the supporting chapter text or the nonbold sentences here in the ES if needed. (Mastrandrea, Michael, IPCC WGII TSU)
107	30	3	40	3	42	This statement is not supported by text in chapter 30. Please provide support, and also specify what this range of temperatures represents--is this across RCP scenarios, and for what timeframe? (Mastrandrea, Michael, IPCC WGII TSU)
108	30	3	41	3	42	Delete "and hence ocean temperatures". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
109	30	3	42	3	42	The fact that the blanket term "chemistry" needs to be immediately qualified with parentheses suggests that it's not the right term. Suggest changing to : "Ocean pH, carbonate concentrations, and oxygen concentrations are virtually..." (UNITED STATES OF AMERICA)
110	30	3	42	3	44	For this statement, it would be best to indicate the approximate time frame and scenarios of climate change for the comparison provided. (Mach, Katharine, IPCC WGII TSU)
111	30	3	42	3	44	Please specify the timeframe intended here. (Mastrandrea, Michael, IPCC WGII TSU)
112	30	3	44	3	44	Repetition: "if atmospheric CO2 continues to increase in the atmosphere" omit "atmospheric" thus, "if CO2 continues to increase in the atmosphere" (Head, Erica, Fisheries and Oceans Canada)
113	30	3	44	3	44	Remove "in the atmosphere". (Lough, Janice, Australian Institute of Marine Science)
114	30	3	44	3	44	Delete "in the atmosphere" as this repeats (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
115	30	3	44	3	46	Is it possible to indicate more precisely what "substantial" and "fundamental and far-reaching" mean here? (Mach, Katharine, IPCC WGII TSU)
116	30	3	44	3	46	The phrases "substantial" and "fundamental and far-reaching" do not clearly communicate, as they will mean different things to different people. Please specify in clear terms what is meant. (Mastrandrea, Michael, IPCC WGII TSU)
117	30	3	47	3	47	Change "ocean ecosystems" to "many ocean ecosystems". It's not certain whether the microbiome will change and offer different goods and services. Without making this change, "they" later in the line is also going to be too broad. (UNITED STATES OF AMERICA)
118	30	3	50	3	50	In place of "fundamental and extensive changes" it would be preferable to indicate broadly what specific changes have occurred. (Mach, Katharine, IPCC WGII TSU)
119	30	3	50	3	54	This information is repetitive with statements in Ch. 6 Executive Summary, p4, L22-25. It is suggested that this information be limited to Ch. 6 ES (UNITED STATES OF AMERICA)
120	30	3	50	4	5	Please ensure full support for this paragraph in chapter 30. Section 30.3.1 is relevant to the statement on page 3 lines 52-53. (Mastrandrea, Michael, IPCC WGII TSU)
121	30	3	52	3	54	It would be helpful to specify the timeframe over which these changes have been observed. (Mach, Katharine, IPCC WGII TSU)
122	30	3	53	3	53	Do we really have evidence that marine organisms arealready adapting "evolutionarily"? (Lough, Janice, Australian Institute of Marine Science)
123	30	3	53	3	53	Is it true that evolutionary (not behavioral) adaptation is occurring? Is it not true that the rate of global change tends to be too fast to evince much true evolutionary adaptation over a few decades of generations. (UNITED STATES OF AMERICA)
124	30	4	1	4	1	These changes : vague. The previous sentences talk about organism migration and isotherm movement -- which is being specifically talked about here? (UNITED STATES OF AMERICA)
125	30	4	1	4	1	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
126	30	4	1	4	5	This information is repetitive with statements in Ch. 6 executive summary, p4, L22-25. It is suggested that this information be limited to Ch. 6 ES (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
127	30	4	1	4	5	This information is repetitive with statements in Ch. 6 executive summary, p4, L22-25. It is suggested that this information be limited to Ch. 6 ES (UNITED STATES OF AMERICA)
128	30	4	2	4	3	Diverse factors.... Alteration of coastlines": Seems like an odd combination. Does that encompass all of the factors at work, or is it just a sampling? (UNITED STATES OF AMERICA)
129	30	4	5	4	5	Not sure you can say "significantly altered" if there is only medium confidence? According to the guidance note on uncertainty, medium confidence includes limited, medium, or robust evidence with only medium agreement. To me that does not seem that a "significant" alteration has happened, no matter where you set your confidence interval? Is this just lose use of language? (UNITED STATES OF AMERICA)
130	30	4	7	4	7	Ocean....into the ocean seems to go against the IPCC definition of OA. That is, OA can be caused by a number of proceses that alter the pH and saturation state of seawater. OA itself represents a fundamental challenge, but the attribution of OA to a specific cause needs to be justified if that is the authors' contention. (UNITED STATES OF AMERICA)
131	30	4	7	4	16	this is extensively discussed in the mechanisms part in ch6 (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)
132	30	4	7	4	16	This information is repetitive with information in Ch. 6. It is suggested that this information be limited to Ch. 6 ES. (UNITED STATES OF AMERICA)
133	30	4	7	4	16	This information is repetitive with information in Ch. 6. It is suggested that this information be limited to Ch. 6 ES. (UNITED STATES OF AMERICA)
134	30	4	7	4	16	Grossly exaggerated. The ocean has high variability. Carbon dioxide is actually emittd in some regons and it does not seem to harm the ecology. More carbon dioxide will merely increase the saturated regions slighly and decrease the CO2 depleted regions slightly. Evolution will adjust things (Gray, Vincent, Climate Consultant)
135	30	4	8	4	8	It is not completely clear what "fundamental" means here. A more specific statement about sensitivities and impacts would be helpful. (Mach, Katharine, IPCC WGII TSU)
136	30	4	10	0	0	Larval stages are more affected in some taxa but such a general statement is not supported by the metaanalysis of Kroeker et al. (2013) which concluded that enhanced sensitivity of early life history stages is not universal across all taxonomic groups. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
137	30	4	10	0	0	The statement that “there is robust evidence, high agreement and high confidence...” is not supported by the literature and is in stark contrast with chapters 5 and 6. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
138	30	4	10	4	10	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
139	30	4	10	4	10	While there is robust evidence, high agreement and high confidence - this is inconsistent with Chapter 6 which is much les confident and probably better informed. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
140	30	4	14	0	0	Considerably less studies were performed at the community level. Hence “... there are few field studies...” (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
141	30	4	16	4	16	The relevance of section 30.3.1 here is unclear, as ocean acidification is discussed in section 30.3.2. (Mastrandrea, Michael, IPCC WGII TSU)
142	30	4	18	4	19	Over what time frame have these changes been observed? (Mach, Katharine, IPCC WGII TSU)
143	30	4	18	4	30	Please ensure full support for this paragraph in chapter 30. In addition, this paragraph is a mix of observations and projections that is somewhat confusing--please present these distinctly. (Mastrandrea, Michael, IPCC WGII TSU)
144	30	4	19	4	19	Please provide a certainty estmate following "productivity" (UNITED STATES OF AMERICA)
145	30	4	19	4	19	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. If being used as a likelihood term, reflecting a probabilistic basis for its assignment, "very likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
146	30	4	19	4	21	It is not clear how our confidence in these changes is "very likely" when the accompanying confidence summary is "medium evidence, medium agreement" (UNITED STATES OF AMERICA)
147	30	4	19	4	21	This sentence seems to imply that some fisheries will benefit from deoxygenation? Assuming that this is not intended, suggest editting to "positive consequences for some fisheries through higher productivity and negative ones for others...." (UNITED STATES OF AMERICA)
148	30	4	21	4	22	This sentence seems to repeat the first sentence in the paragraph. (UNITED STATES OF AMERICA)
149	30	4	21	4	22	Over what time frame have these changes been observed? Is it possible to specify more precisely what is meant by "major changes"? (Mach, Katharine, IPCC WGII TSU)
150	30	4	22	4	27	The confidence statements for this ES statement contradict a similar statement in Chapter 6, p4, L32-36. Ch 6 ES states "The direction, magnitude, and regional differences of a change of NPP in the open ocean as well as in coastal waters have limited evidence and low agreement for a global decrease projected by 2100. At high (polar) latitude an increase in NPP is also projected with low confidence." However, Ch 30 ES states "In regions where primary productivity has increased (or is predicted to increase) such as....., energy transfer to higher trophic levels is likely to increase along with microbial activity. Increased primary productivity is likely to lead to an increased transfer of organic carbon to deep sea habitats..." The confidence and likelihood statements in these two ES statements seem to contradict one another. It is suggested that the ES statement be limited to only one of the chapters and the text modified to clarify the confusing confidence and likelihood statement. (UNITED STATES OF AMERICA)
151	30	4	27	4	29	Section 30.5.4.1.4 states that OMZs have not increased since the 1960s in the Arabian Sea--please reconcile. In addition, support for the inclusion of the North Sea here is unclear. (Mastrandrea, Michael, IPCC WGII TSU)
152	30	4	30	4	30	I believe the reference to 30.5.6 should be to 30.5.5 instead here. (Mastrandrea, Michael, IPCC WGII TSU)
153	30	4	32	4	32	Tell here what is STG (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
154	30	4	32	4	32	Spell out STGs (AUSTRALIA)
155	30	4	32	4	32	Specify chlorophyll concentrations in the mixed layer. The euphotic zone extends below the mixed layer and chlorophyll concentrations might be increasing there. (UNITED STATES OF AMERICA)
156	30	4	32	4	34	The inclusion of a p-value here is confusing, what is the intent? Is it meant as a counterpart to the calibrated confidence statement, and in what context? I would recommend deletion here and including explanation in the supporting chapter text or the nonbold sentences here in the ES if needed. (Mastrandrea, Michael, IPCC WGII TSU)
157	30	4	32	4	37	First - "Chlorophyll concentrations have decreased in the STGs in the North Pacific, Indian and North Atlantic\n Oceans by 9%, 12% and 11%, over and above the inherent seasonal and interannual variability from 1998 to 2010 (high confidence; p<0.05)". (Head, Erica, Fisheries and Oceans Canada)
158	30	4	32	4	37	As far as I know, satellite estimates of chlorophyll concentration have shown these decreases, while in situ \nobservations in the North Pacific (HOT) and North Atlantic (BATS) have either shown no change or increases over the same study period (Saba et al. 2010). No matter how thorough a statistical analysis is done (e.g. Ventrepotte and Melin, 2011; Signorini and McLain, 2012), there is still no denying that satellites only look at the near-surface layers, which in the STGs are not where most of the chlorophyll is found. (Head, Erica, Fisheries and Oceans Canada)

#	Ch	From Page	From Line	To Page	To Line	Comment
159	30	4	32	4	37	Next "Significant warming over this period has resulted in increased water column stratification and reduced mixed \nlayer depth." I do not think this sentence is entirely correct either, since at HOT, over the 1989-2007 period SST increased and the annual (and winter) average mixed layer depth increased (Saba et al. 2010). At BATS, between 1988 and 2006 there was no significant change in SST, but the winter (but not annual average) mixed layer depth deepened. Carton et al. (2008) analysed changes in mixed layer depth in the northern hemisphere between 1960 and 2004, and found a deepening trend over time, which they ascribed to trends in atmospheric and hydrographic processes (e.g. ENSO, PDO etc), i.e. in their analysis the anticipated long-term effect of ocean warming on MLD was not the dominant driver. Refs - Carton, J.A., Grodsky, S.A, Liu, H. (2008) Variability of the oceanic mixed layer, 1960-2004. Journal of Climate 21, 1029-1047/ Saba et al. (2010) as in Chapter 6 reference list (Head, Erica, Fisheries and Oceans Canada)
160	30	4	32	4	37	Next "This has reduced vertical transport of nutrients into the upper layers of the Ocean and has reduced primary \nproduction." Again, this statement is contrary to in situ observations at HOT and BATS. At these sites nutrient levels increased, and at these and several other low latitude time series stations (See Chapter 6, Figure 6-5) primary production has apparently been increasing. (Head, Erica, Fisheries and Oceans Canada)
161	30	4	32	4	37	Again - it is mainly the studies of Behrenfeld et al. (2006) and Vantrepotte and Melin (2011) based on remote \nsensing, I think, that are used as evidence that near surface chlorophyll concentrations, and the estimates of primary production based on them, decreased over the 1999-2005 period in the sub-tropical gyres. These results do get some support from in situ CPR (Continuous Plankton Recorder) observations in the eastern sub-tropical North Atlantic (Richardson and Shoeman, 2004), where phytoplankton biomass showed a downward trend, but the same study showed an increasing trend in phytoplankton biomass farther north in the NE Atlantic, in the region where Ventrepotte and Melin (2011) found decreasing (satellite) chlorophyll levels. As well, in the NW Atlantic phytoplankton biomass measured by the Continuous Plankton Recorder (and by inference primary production) has been increasing over the last few decades (Head and Pepin 2010a), including between 1998 and 2006, the latter being a period over which satellite observations showed little change (Head and Pepin, 2010b). Ref: Head, E.J.H., Pepin, P. (2010a) Spatial and inter-decadal variability in plankton abundance and composition in the Northwest Atlantic (1958-2006). J. Plank. Res. 32, 1633-1648 / (Head, Erica, Fisheries and Oceans Canada)
162	30	4	32	4	37	Head, E.J.H., Pepin, P. (2010b) Monitoring changes in phytoplankton abundance and composition in the Northwest Atlantic: a comparison of results obtained by continuous plankton recorder sampling and colour satellite imagery. J. Plank. Res. 32, 1649-1660 (Head, Erica, Fisheries and Oceans Canada)
163	30	4	32	4	37	Overall, I don't think we can have "high confidence" in the interpretation of any one set of observations, since the \neffects of long-term warming can be confounded by other environmental processes (e.g. ENSO, PDO, NAO, winds, eddies, advection) that operate on shorter time scales, and that are, for now, apparently counteracting the effects of ocean warming in some areas. Refs Behrenfeld et al. (2006) as in Chapter 30 refs/ Richardson ahd Schoeman (2004) as in Chapter 6 refs (Head, Erica, Fisheries and Oceans Canada)
164	30	4	32	4	37	I think Chapter 6 deals with this subject better, since it includes the uncertainty that the different lines of evidence \nprovide. Thus, note the text in the executive summary (Chapter 6, Page 4, lines 32-36) and there is also the discussion/justification (more-or-less as I have outlined above) in Chapter 6, Page 12, Lines 1- 14. (Head, Erica, Fisheries and Oceans Canada)

#	Ch	From Page	From Line	To Page	To Line	Comment
165	30	4	32	4	37	I think it is important that statements in the executive summaries of two different Chapters do not contradict each \nother, so, overall I would prefer to see something like this here in Chapter 30: "Satellite observations showed broad-scale decreases in chlorophyll concentration in the STGs of about 10% in the North Pacific, North Atlantic and Indian Oceans between 1998 and 2010, although in situ observations at two sites did not (6.3.1, 6.3.2, 6.3.3, high confidence). In general, it appears that significant warming of the Ocean has resulted in increased water column stratification, reduced mixed layer depths, and reduced vertical transport of nutrients into the upper layers, leading to reduced primary production in the STGs. In situ observations at HOT and BATS (North Pacific and North Atlantic STGs) do not, however, follow these large-scale trends, suggesting that locally other processes (e.g. ENSO, PDO, NAO, winds, eddies, advection) can counteract general trends. Changes in primary production by phytoplankton are likely to impact food availability for pelagic fish species, although these effects may be mitigated by re-distributions of species among regions (medium confidence). The influence of variability over different spatial and temporal scales complicates attribution of past changes directly to climate change, but changes in ocean primary production, chlorophyll and other key biogeochemical processes etc" (Head, Erica, Fisheries and Oceans Canada)
166	30	4	33	4	33	over and above feels a bit colloquial and is also a bit ambiguous. Are the percentages given reflecting the long-term signal (not just seasonal or inter-annual variability), or they are in addition to trends over the 13 years that are attributed to natural variability? (Mach, Katharine, IPCC WGII TSU)
167	30	4	34	4	34	high confidence, p<0.05: Not necessary to combine a confidence statement and a likelihood statement. (UNITED STATES OF AMERICA)
168	30	4	34	4	34	Significant usually connotes statistical certainty. If so, please include uncertainty estimate. If not, substitute another term like "substantial" or "measurable" (UNITED STATES OF AMERICA)
169	30	4	39	4	39	Consider changing to "past observed changes" for more precision. (UNITED STATES OF AMERICA)
170	30	4	40	4	40	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
171	30	4	41	4	41	The reference to 30.5.5.1 should be to 30.5.6.1 instead here. (Mastrandrea, Michael, IPCC WGII TSU)
172	30	4	42	4	50	The temperature has not been rising since 2000 (Gray, Vincent, Climate Consultant)
173	30	4	43	4	44	Over what broad timeframe has this effect been observed? Also, it would be preferable to indicate more precisely what is meant by "significant impacts." (Mach, Katharine, IPCC WGII TSU)
174	30	4	43	4	44	Please specify what impacts on coastal ecosystems are meant here. (Mastrandrea, Michael, IPCC WGII TSU)
175	30	4	43	4	50	This issue concerns coastal systems and is therefore covered in chapter 5. A link to it seems needed. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
176	30	4	44	4	44	Very likely seems to contradict the use of "may" in the next line. Suggest reconsidering which uncertainty modifier to use. (UNITED STATES OF AMERICA)
177	30	4	44	4	46	For the described projected degradation, what is the role of climate change versus other drivers of change in these systems, and what is the general time frame and levels of climate change that would be expected to pose "substantial challenges? (Mach, Katharine, IPCC WGII TSU)
178	30	4	45	4	45	Delete “intertidal” – littoral better as Mediterranean not tidal (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
179	30	4	46	4	46	Please, define "ecosystem health", add a reference or substitute the term. A scientific definition of the term and/or a definition of the difference between "healthy ocean ecosystems " and "sick ocean ecosystems" is necessary here. Please substitute in the text:'…on ecosystem health.' by '… on functioning ecosystems.'. (GERMANY)
180	30	4	46	4	50	Please ensure full support for this passage in chapter 30. (Mastrandrea, Michael, IPCC WGII TSU)
181	30	4	48	4	50	Likewise, making the point about the value of reducing other regional stressors to increase resilience is very important. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
182	30	4	49	4	50	Evaluate level of agreement in addition to quality of evidence. For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
183	30	4	52	4	52	How are the systems "changing"? It would be preferable to specify this within the bold finding. (Mach, Katharine, IPCC WGII TSU)
184	30	4	52	5	6	There seems to be no section 30.8.3 in the manuscript; Chapter 30.6.2.1.3 mifght be added as the source\n\n (NETHERLANDS)
185	30	4	54	4	54	When did observations begin? Stating that "changes observed since the late 1970s" seems unnecessarily vague. How much of the time span has been marked by large change? (UNITED STATES OF AMERICA)
186	30	5	5	5	5	both positive and negative: vague. More specifics would be helpful. (UNITED STATES OF AMERICA)
187	30	5	5	5	6	Section 30.8.3 does not exist. Please update this line of sight. (Mastrandrea, Michael, IPCC WGII TSU)
188	30	5	8	5	15	Are these usages of "likely" and "very likely" correct? It doesn't seem that these statements could be backed up with probabilities, but rather should be qualified with qualitative confidence statements instead. (UNITED STATES OF AMERICA)
189	30	5	11	5	11	The AMO is mentioned here, but what about the other climatic cycles that are cited throughout the rest of the chapter. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
190	30	5	13	5	15	Please ensure full support for this passage in chapter 30. In addition, it appears that the reference to section 30.5.6 should be to 30.5.3 instead here. (Mastrandrea, Michael, IPCC WGII TSU)
191	30	5	14	5	14	Consider substituting "in early stages" instead of "undeveloped". (UNITED STATES OF AMERICA)
192	30	5	17	5	17	It is not clear what is meant by "compelling" in this finding. (Mach, Katharine, IPCC WGII TSU)
193	30	5	17	5	26	Please ensure full support for this finding in chapter 30. (Mastrandrea, Michael, IPCC WGII TSU)
194	30	5	18	5	18	To give a more complete description of the size of the deep sea, I think it would be good to include an estimate of the fraction of the biosphere's total volume that is found in the deep sea (below about 3,800 m). The number is greater than 90%. This percentage volume figure might have more impact than the surface area percentage that is given here. (Somero , George , Stanford University)
195	30	5	21	5	21	Remove "(through intensified upwelling)". (Lough, Janice, Australian Institute of Marine Science)
196	30	5	21	5	21	through intensified upwelling in some regions (through intensified upwelling) = typo? If not, I don't get this sentence at all. (UNITED STATES OF AMERICA)
197	30	5	21	5	21	Replace "strategies" with "opportunities". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
198	30	5	21	5	21	It would be preferable to specify more precisely what is meant by "threatens"--"would increase the occurrence of hypoxia" in these systems? (Mach, Katharine, IPCC WGII TSU)
199	30	5	22	5	22	Similarly doesn't make sense here. (UNITED STATES OF AMERICA)
200	30	5	24	5	24	due to the amplifying influence of rising deep water temperatures... Doesn't really make sense, since microbial metabolism isn't a cyclic signal. Consider instead, "due to the enhancement of microbial metabolism caused by rising deep water temperatures". (UNITED STATES OF AMERICA)
201	30	5	24	5	24	These changes are virtually certain - How can this be true when the probability of a decline in plankton productivity is cited as highly uncertain in chapter 6!!!! Also standardisation of terms such as "virtually certain" is needed, as loose phrases like this are used throughout chapter 30. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
202	30	5	24	5	25	It appears that this statement may be more appropriate for an assignment of very high confidence, given the available evidence. (Mastrandrea, Michael, IPCC WGII TSU)
203	30	5	30	5	30	as waters warm and acidify: it is still speculation as to whether distribution of fish/invertebrates will markedly change in response to acidification. Suggest revising to rely more on observed evidence. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
204	30	5	30	5	30	Wording on lines 30 and 33 ("will dictate the need" and "will require") should be carefully considered to ensure policy neutral statements. (Mach, Katharine, IPCC WGII TSU)
205	30	5	30	5	31	Define acronyms UNCLOS and LOSC. (Lough, Janice, Australian Institute of Marine Science)
206	30	5	31	5	31	Are all tuna species sensitive to changes in temperature? - I assume so, in which case there should be this change\n "For example, tuna, key fisheries species, are highly sensitive" (Head, Erica, Fisheries and Oceans Canada)
207	30	5	34	5	34	Please check the line of sight here. It is not clear that 30.5.5.2 is relevant, and 30.6.2 also appears to contain relevant material. (Mastrandrea, Michael, IPCC WGII TSU)
208	30	5	36	5	37	For this statement, the relevant time frames and levels of climate change, assumptions underpinning the conclusion, and differences across geographic areas should be specified. (Mach, Katharine, IPCC WGII TSU)
209	30	5	36	5	44	Do you need to include here that climate change impacts are superimpoed on over-exploitation of many fisheries combined with the added pressure of population growth? (Lough, Janice, Australian Institute of Marine Science)
210	30	5	36	5	44	Here, and in Section 30.6, the authors should address the compounding effect of current and future overfishing to the impacts of climate change on food for coastal populations. Alternatively, the authors should coordinate with authors teams from Ch 7 and 10 to see where this discussion is best placed. (UNITED STATES OF AMERICA)
211	30	5	36	5	44	This section doesn't say anything about the suggestion that high latitude counties will possibly benefit from increased fisheries (only mentions the negative effects). This issue is mentioned throughout chapter 6. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
212	30	5	39	5	40	For the described fisheries decline, what are the other relevant drivers of change? It would seem important to acknowledge them here. (Mach, Katharine, IPCC WGII TSU)
213	30	5	40	5	40	Does rapid anthropogenic climate change here refer to specific scenarios, or is this a more general statement? Please clarify. (Mastrandrea, Michael, IPCC WGII TSU)
214	30	5	40	5	42	Repetitive -- already said in lines 36-37. (UNITED STATES OF AMERICA)
215	30	5	43	5	44	Confusing as written. Suggest "Understanding of these changes ... is important although studies are limited." (UNITED STATES OF AMERICA)
216	30	5	46	5	47	This sentence (in bold) doesn't make sense grammatically (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
217	30	5	48	5	48	Management doesn't "include" climate change. It "accommodates" or "plans for" climate change. Suggest revising (UNITED STATES OF AMERICA)
218	30	5	50	0	0	(e.g. bottom trawling, 'ghost' fishing) should be changed to "(e.g. illegal, unreported and unregulated fishing)," because these two descriptions (bottom trawling, 'ghost' fishing) are not discussed in this chapter and "IUU fishing" is discussed in P.48, l.27. (JAPAN)
219	30	5	52	0	0	The words "improved fishery management, including" should be inserted before "marine protected areas," because MPA is one of management measures in the field of fishery management (See p.34, l.17 - 18 and p.62, l.39 for information). (JAPAN)
220	30	5	52	5	52	Use of "require" should be avoided here to ensure a policy neutral statement. (Mach, Katharine, IPCC WGII TSU)
221	30	5	52	5	53	This sentence is awkwardly worded. Rather than "...movement of people and industry sectors", mention the [primary sectors, for example "...movement of people and ocean-based industries such as shipping, oil/gas, ..." (UNITED STATES OF AMERICA)
222	30	5	53	5	53	require similar strategiesis vague. Do the authors mean flexible thinking? Solutions that transcend geography? More specifics are needed. (UNITED STATES OF AMERICA)
223	30	5	54	5	54	Section 30.6.2 also appears to be relevant here. (Mastrandrea, Michael, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
224	30	6	2	6	3	Suggest that the authors include fisheries as an industry sector that is particularly vulnerable to the climate change impacts listed here. (UNITED STATES OF AMERICA)
225	30	6	2	6	8	Are the impacts of changing surface winds, sea level, wave height, and storm intensity on shipping, oil, gas, and mineral extraction covered in another chapter? The authors should check for redundancy with Ch 10.4.4 and 10.2.2 and relevant pieces of Sec. 30.6 and make appropriate cross-references. (UNITED STATES OF AMERICA)
226	30	6	5	6	5	Use of "require" here should be avoided to ensure a policy neutral statement. (Mach, Katharine, IPCC WGII TSU)
227	30	6	6	6	7	As written, this sentence suggests "new opportunities for international issue over access...". Suggest rewriting for clarity. (UNITED STATES OF AMERICA)
228	30	6	10	6	17	Please ensure full support for this finding in chapter 30. (Mastrandrea, Michael, IPCC WGII TSU)
229	30	6	12	6	14	Encourage the authors to rephrase this statement to read: "Given the challenge of mitigating ocean warming and acidification directly, and the time it will take to accomplish this, adapting fisheries.... under climate change until then." (UNITED STATES OF AMERICA)
230	30	6	12	6	14	In the 1st phrase of this sentence, would it be clearer to discuss climate change that is essentially locked in over the coming decades? For the 2nd half of the statement, it may be beneficial to broadly specify the relevant time frame (for example, near-term versus long-term within the century), levels of climate change, and other relevant drivers. (Mach, Katharine, IPCC WGII TSU)
231	30	6	19	6	27	Please ensure full support for this finding in chapter 30. (Mastrandrea, Michael, IPCC WGII TSU)
232	30	6	20	6	21	The wording of "ecosystems...represent...strategies" seems a bit nonparallel and could be adjusted. (Mach, Katharine, IPCC WGII TSU)
233	30	6	20	6	23	In the sentence "Reducing highly anoxic habitats through coastal restoration…." it is not clearly described, which habitats are meant. Please add examples. If habitats like mangroves, sea grass, salt marshes are meant, we do not support the idea "to reduce" these natural often protected habitats by "coastal restoration". (GERMANY)
234	30	6	21	6	21	Suggest changing to "significant local carbon sequestration" (UNITED STATES OF AMERICA)
235	30	6	21	6	22	significant mitigation opportunities - this seems to be speculative since the research on blue carbon is still early. Suggest "may represent mitigation opportunities" or provide references to support the definitive nature of the original statement. (UNITED STATES OF AMERICA)
236	30	6	21	6	22	Move "(and hence the emission of methane)" to after "anoxic habitats" (UNITED STATES OF AMERICA)
237	30	6	23	6	23	Chapter 30.6.1 and Chapter 30.6.4.2 should be added as the source, Chapter 30.7 does not seem to be the appropriate source of the texts\n\n (NETHERLANDS)
238	30	6	23	6	23	It's not clear what is to be understood about these opportunities. Needs more specifics. (UNITED STATES OF AMERICA)
239	30	6	29	6	29	International frameworks haven't been proven yet; saying that they "represent vital tools" seems a bit strong. (UNITED STATES OF AMERICA)
240	30	6	29	6	36	In the Executive Summary, the relevant sub-sections of the chapter are not consistently cited (e.g., p. 6, line 29-36) (UNITED STATES OF AMERICA)
241	30	6	29	6	36	Please specify line of sight for this paragraph, which it appears should be 30.6.7. (Mastrandrea, Michael, IPCC WGII TSU)
242	30	6	31	6	31	Suggesting using a synonym so that "common" doesn't appear twice in one sentence. (UNITED STATES OF AMERICA)
243	30	6	32	6	34	This passage seems to be rather subjective and not as balanced as it should be. Sugest revision or removal. (UNITED STATES OF AMERICA)
244	30	6	33	6	33	Insert "mounting" before "collaborative" to make the sentence construction parallel (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
245	30	6	39	8	18	Somewhere in the Introduction, a comment on the relationship betwen this Chapter and Chapter 6, and perhaps the other regional chapters (e.g., Polar) is merited. (UNITED STATES OF AMERICA)
246	30	6	41	6	54	This section should include a statement that differentiates the objectives of Ch. 30 from Ch. 6 since there is so much repetitious material in these chapters. (UNITED STATES OF AMERICA)
247	30	6	44	6	44	gas content trace gas? greenhouse gas? (Christian, James, Government of Canada)
248	30	6	44	6	46	The remit of this chapter is a bit confusing -- hypoxia is mentioned, but effects of climate change on other nutrient cycles (e.g., N, S, P), iron dust release to open oceans, mercury (and other metal) cycles' influence on the open oceans, etc. are not. It could provide a more even a view of the chemical cycling aspects of global change in the ocean. Many of these topics are associated with dust and particulates emitted by human activities that do alter planetary radiative forcing. Refer to section in Ch 19 on climate change / OA impact on N fixation and trace elements (e.g., Fe). The authors should coordinate with author team of Ch 6 to determine where this discussion is best placed. (UNITED STATES OF AMERICA)
249	30	6	50	6	50	Key: how were these chosen? The major uses? Major moneymakers? The language is vague and should be clarified. (UNITED STATES OF AMERICA)
250	30	7	3	7	33	Consider Marine Ecosystems of the World Regions for coasts (Spalding et al.) (UNITED STATES OF AMERICA)
251	30	7	7	7	9	Not only.... enormous region. Suggest that this sentence be deleted. It is vague and not informative. (UNITED STATES OF AMERICA)
252	30	7	10	7	11	This discussion overlaps with chapter 6, and material from Chapter 6 could potentially be dropped. If chapter 6 maintains its figure for these provinces, the figure could be cross-referenced here. (Mach, Katharine, IPCC WGII TSU)
253	30	7	13	7	14	Unclear how subregions were determined if the approach is only "similar" to the way Barber did it. Please provide more detail. (UNITED STATES OF AMERICA)
254	30	7	15	7	19	Condense the description of caveats. (UNITED STATES OF AMERICA)
255	30	7	17	7	17	delete first "with" in this line. (Somero , George , Stanford University)
256	30	7	17	7	17	Sentence has an extra "with" (UNITED STATES OF AMERICA)
257	30	7	20	7	20	As a minor point, presumably "systems" should be inserted after "spring bloom." (Mach, Katharine, IPCC WGII TSU)
258	30	7	24	7	33	Figure 30-1 generally ok, but the caption refers to region "7" deep sea, but this is not included on the map. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
259	30	7	35	7	37	Table 30-1 OK but largely repeats data that is included in figure 30-1 (panel B) (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
260	30	7	42	7	42	I see only one goal here, hence "The primary goal of Chapter 30 is to assess the recent literature etc" (Head, Erica, Fisheries and Oceans Canada)
261	30	7	42	7	43	I think this statement needs revising. Is the primary goal of this chapter really to assess literature pertaining to "detection and attribution" of changes in the Ocean? The term "detection and attribution" has a specific meaning which I don't think is really the central objective of the Chapter - I would suggest instead using something similar to that in the ES ("[...] we assess the evidence for changes due to anthropogenic climate change [...]"), since there is not much content in the chapter that refers to formalised detection and attribution. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
262	30	7	46	7	46	ocean salinity on freshwater fluxes??? (Christian, James, Government of Canada)
263	30	7	51	7	51	Change to "Whether the processes associated with climate change" since follow-on processes, like reduced upwelling etc. are discussed at length here (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
264	30	7	51	7	52	This is quite a vague definition of attribution, which has a very specific meaning in D&A. Rather than exclusively investigate the role of climate change in an observed change, "attribution potentially includes antecedent conditions and natural variability among the multiple causal factors contributing to an observed change or event" [WG1 10.2.1]. Suggest to clarify or to amalgamate with the statement on Page 8, Line 2. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
265	30	7	54	7	54	challenges = Biological challenges? Measurement challenges? It is confusing as to what is meant here. (UNITED STATES OF AMERICA)
266	30	8	6	8	6	There is no Chapter 18 in AR5 WGI. Please correct the reference. (Plattner, Gian-Kasper, IPCC WGI TSU)
267	30	8	6	8	6	The reference to working group 1 is unclear, as the volume does not contain a chapter 18. (Mach, Katharine, IPCC WGII TSU)
268	30	8	11	8	11	It is specifically the "structural uncertainty" in model simulations which confound D&A (e.g. Hegerl and Zwiers, 2011). i.e. model errors in terms of the magnitude of forced response are accounted for by D&A methods. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
269	30	8	15	8	15	Please change the term "frustrating". The term describes an emotion. To our opinion such "emotional terms" should not be part of a scientific text. (GERMANY)
270	30	8	17	8	17	Stressors = jargon. Define or rephrase. (UNITED STATES OF AMERICA)
271	30	8	21	8	52	It is advisable that some reference be made to the Ch. 6 discussion at the end of this section, indicating that Ch. 6 provides the foundation for this discussion. (UNITED STATES OF AMERICA)
272	30	8	21	9	29	Check this section for repetition with other chapters. (UNITED STATES OF AMERICA)
273	30	8	27	8	27	reducing a key opportunity to synthesize: This statement is confusing. Presumably having information spread throughout multiple places would provide a synthesis opportunity? (UNITED STATES OF AMERICA)
274	30	8	31	9	36	Page 8 line 31 states that the ocean has taken up over 80% of the heat, while page 9 line 36 states > 90 %. Please confirm the correct value and edit as appropriate. (UNITED STATES OF AMERICA)
275	30	8	37	8	37	very likely should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
276	30	8	39	8	29	By "definitive evidence" does the chapter team mean evidence that slowing had already occurred? This could be clarified. (Mach, Katharine, IPCC WGII TSU)
277	30	8	39	8	39	The MOC is not really discussed in this chapter. Should this passage be revised or refer to other sections of AR5 (e.g., Sec. 3.6.3 of WG1)? (UNITED STATES OF AMERICA)
278	30	8	41	8	41	It should read "United States and in the United Kingdom" or otherwise it reads as if talking only about the eastern coasts of the UK (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
279	30	9	4	9	4	Surely there must be a better reference than Hayes et al. 2001 for this. The Hayes et al article is about potential \ncauses of "disease epidemics, mass mortalities, harmful algal blooms and other population explosions" during a particular period, when the authors suspected increased Fe supply to the N Atlantic may have caused increased primary production, including that of pathogens. (Head, Erica, Fisheries and Oceans Canada)
280	30	9	17	9	18	It would be useful to include a paragraph highlighting the differences in scope between AR5 chapters 6, 29 and 30 as this is not immediately obvious. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
281	30	9	19	9	19	The plots and tables in this section were prepared by the authors of this assessment report, rather than taken from the literature or from the WG I report. That raises question of how the plots were made (corrections to data, accounting for known problems, etc.). Furthermore, this is no longer purely an assessment of the literature. We think that this creates an undesirable situation. \n\n (NETHERLANDS)
282	30	9	22	9	22	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
283	30	9	23	9	24	For this statement, the description of changes in chemistry should presumably more precisely match wording use within working group 1. Additionally, the specific supporting chapter (or charter sections) should be specified. (Mach, Katharine, IPCC WGII TSU)
284	30	9	24	9	25	Please specify the reference to AR5 WGI Ch3. (Plattner, Gian-Kasper, IPCC WGI TSU)
285	30	9	25	9	29	What is an "expert" archive or "expert" data set? (Lough, Janice, Australian Institute of Marine Science)
286	30	9	32	18	48	Sections 30.3.1 and 30.3.2 are very similar to WG2 Section 6.1.1. More work is required to improve the consistency of messages between Chapters 6 and 30 of WG2. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
287	30	9	36	9	36	There is a missing "the" in this sentence - i.e., "that the Ocean..." (UNITED STATES OF AMERICA)
288	30	9	36	9	37	The broad timeframe (since preindustrial?) could be specified. (Mach, Katharine, IPCC WGII TSU)
289	30	9	36	9	37	The executive summary specifies a timeframe of since 1950 for this statement--please clarify here. (Mastrandrea, Michael, IPCC WGII TSU)
290	30	9	39	9	40	in section 30.3.1.6 (page 15, lines 16-17) it is stated that warming of the ocean resulted in a 4% increase in thermal stratification in the upper layers in the ocean EXCEPT in the Southern Ocean\n\n (NETHERLANDS)
291	30	9	40	9	40	4% of what ? (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
292	30	9	40	9	41	Since Gleckler et al. [2012] further D&A work has been done on ocean temperature. Suggest to include reference to Pierce et al. [2012], GRL, here. This study used the most recent CMIP5 data (rather than CMIP3 in Gleckler et al. [2012]) and corrects for spurious 1970s-80s warming in the observations. This is also more consistent with the analysis of CMIP5 models displayed in Table 30-3. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
293	30	9	41	9	41	Virtually certain, p<0.01: is this double uncertainty language consistent with IPCC guidance? (UNITED STATES OF AMERICA)
294	30	9	42	9	42	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
295	30	9	46	9	50	What are ".2median SSTs"? Should also note that the "globally-complete fields" of HadISST are derived by interpolation/reconstruction for data sparse locations and time periods. Some comment about how this data set compares with other "reconstructions" from observations (e.g. ERSST) is also perhaps warrented; see, for example Deser et al (2010) Twentieth century tropical sea surface temperature trends revisited. Geophysical Research Letters 37, doi:10.1029/2010GL043321; Deser et al (2010) Sea surface temperature variability: patterns and mechanisms. Annual Review Marine Science 2: 115-143; Solomon & Newman (2012) Reconciling disparate twentieth-century Indo-Pacific ocean temperature trends in the instrumental record. Nature Climate Change doi:10.1038/NCLIMATE1591. (Lough, Janice, Australian Institute of Marine Science)
296	30	9	46	12	2	The text becomes difficult to read to the non-expert because of jargon. What is "published HadISST 1.1" What is ".2median SSTs"? It is suggested that phrases such as published long-term SST data (HadISST 1.1) be used. [perhaps also including information on how the data was collected, e.g. satellite, shipboard, etc.). Does this mean the SSTs for the nearest 0.2 meridional degree? Recommend something to make this more accessible yet retain the necessary citations. The precision is needed, for sure, but very few will know these terms which would be better in parentheses or set off by commas for the first use. (UNITED STATES OF AMERICA)
297	30	9	47	9	47	.2 ?? (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
298	30	9	47	9	47	0.2median ??? (Christian, James, Government of Canada)
299	30	9	52	9	53	Probabkly more accurate to say that all ocean basins are warming but that rates of warming differ. (Lough, Janice, Australian Institute of Marine Science)

#	Ch	From Page	From Line	To Page	To Line	Comment
300	30	10	0	0	0	There is reference made to Figure 30-3 E in this section. However, there is no panel "E" in the figure. The caption, here and on page 108, the caption referest to "E" yet no "E" exists (UNITED STATES OF AMERICA)
301	30	10	0	0	0	Table 2 - I find the changes listed for the North Pacific and North Atlantic implausibly large (>3K over 50 years, over vast areas of ocean, and in one case >6) (see also 20/54 and 23/25). I do not have time to try to reproduce this analysis exactly but the data sets I have consulted don't show changes of anything like this magnitude, nor can I find anything in Ch. 3 of the WG1 report that supports this. I also don't see why 3 sf's are required for these numbers whose uncertainty is easily +/-0.1K. (Christian, James, Government of Canada)
302	30	10	1	10	1	Table 30.2 could benefit from a but of clarification: I do not understand why the years used in columns 3, 5 and 6 are different? How were values "Index of Varibility" calculated - it does not seem to be a simple ratio of the 2 values; also, not sure "Index of Varibility" is the appropriate term to use. This is, however, a useful exercise as linear trends can be distorted by start and end values so comparing averages for 2 different time period is more meaningful; probably also worth highlighting those values in column 6 which are significantly different between the 2 time periods. (Lough, Janice, Australian Institute of Marine Science)
303	30	10	2	10	3	Does "southern portions of the HLSBS" mean the southern hemisphere HLSBS ? Northern hemisphere HLSBS is also mentioned, so it is unclear as to if this means the southern portion of the northern hemisphere HLSBS, but the text doesn't indicate that. Please clarify. (UNITED STATES OF AMERICA)
304	30	10	12	10	12	Do you really mean to refer to Figure 30-12B here? (Lough, Janice, Australian Institute of Marine Science)
305	30	10	15	10	16	These more recent....long-term variability seems to be explaining away the lack of significant change. This does not sound especially objective. (UNITED STATES OF AMERICA)
306	30	10	16	10	21	See also, regarding warming of tropical coral reef regions: Lough (2012) Small change, big difference: sea surface temperature distributions for tropical coral reef ecosystems, 1950-2011. J Geophysical Research 117, doi: 10.1029/2012JC008199. (Lough, Janice, Australian Institute of Marine Science)
307	30	10	32	10	36	Looking at figure 30-3, this seems to contradict some of the statements in the paragraph above about regional trends and changes. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
308	30	10	33	10	36	Figure 30-3 - caption needs clarifying; the analyses are for the global oceans and not "different ocean sub-regions"; also need to explain the "velocity" and "shift" calculations; is this based on Burrows et al (2011) work - if so, then should be stated. (Lough, Janice, Australian Institute of Marine Science)
309	30	10	33	10	36	Figure 30-3 - caption needs clarifying; the analyses are for the global oceans and not "different ocean sub-regions"; also need to explain the "velocity" and "shift" calculations; is this based on Burrows et al (2011) work - if so, then should be stated. (Lough, Janice, Australian Institute of Marine Science)
310	30	10	34	10	34	Here and elsewhere in the chapter: Velocity = speed + direction, but no direction is ever given. Is the assumption that direction is poleward? Please specify. (UNITED STATES OF AMERICA)
311	30	10	35	10	36	Fig 30.3. Explain what is shift in season change that "drive natural history events". It is uncomprenhensible. (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
312	30	10	45	10	54	Table 30.2 could benefit from a but of clarification: I do not understand why the years used in columns 3, 5 and 6 are different? How were values "Index of Varibility" calculated - it does not seem to be a simple ratio of the 2 values; also, not sure "Index of Varibility" is the appropriate term to use. This is, however, a useful exercise as linear trends can be distorted by start and end values so comparing averages for 2 different time period is more meaningful; probably also worth highlighting those values in column 6 which are significantly different between the 2 time periods. (Lough, Janice, Australian Institute of Marine Science)
313	30	10	54	10	54	Table 30.2….that exceed 0.05 (non significative) (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
314	30	11	0	0	0	First paragraph - "across the ocean", line 8 does not make sense. Please clarify. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
315	30	11	6	11	6	Should be Hoegh-Guldberg, 2012, without the 'b' (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
316	30	11	6	11	6	Should 'aclimatize' be 'aclimate'? (UNITED STATES OF AMERICA)
317	30	11	7	11	10	Lower velocities (cooling) in central and north Pacific, and Atlantic seems to contradict the general statement above in line 8 that isotherms are moving at high velocities 'across the ocean'. The authors should clarify that is happening in low latitudes. (UNITED STATES OF AMERICA)
318	30	11	9	11	9	contracting isotherms -- what direction? It is not obvious from the plots etc. (UNITED STATES OF AMERICA)
319	30	11	13	11	13	are likely to -- is the uncertainty range of 66-100% probability meant here? Otherwise, change to "may have impacts" (UNITED STATES OF AMERICA)
320	30	11	13	11	13	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
321	30	11	30	11	32	Have bleaching events really occurred every 2-3 years in most coral reef sub-regions? Reference? (Lough, Janice, Australian Institute of Marine Science)
322	30	11	44	11	47	Are these the same models used by WG1? (Lough, Janice, Australian Institute of Marine Science)
323	30	11	44	12	2	Please update relevant SST projection statements to ensure consistency and cross-referencing with the relevant WGI AR5 chapters. (Plattner, Gian-Kasper, IPCC WGI TSU)
324	30	11	47	11	48	Looking at Figure 30-2, CMIP5 models forced with natural-only forcings are included ("historicalNat") along with shading for where there is overlap with the all forcings simulations. However these results are not discussed in the text (in terms of agreement with observations or the shaded overlap between "historical" and "historicalNat" experiments). This should be discussed in 30.3.1.1. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
325	30	12	4	12	5	I could not understand why the models were limited? CMIP-5 includes much more models and other models must be included. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
326	30	12	23	12	23	It is assumed that the reference to (3.7.2) should be (WGI 3.7.2)? (UNITED STATES OF AMERICA)
327	30	12	23	12	23	Please specify the reference to WGI Ch3.7.2. (Plattner, Gian-Kasper, IPCC WGI TSU)
328	30	12	23	13	4	This section only seems to have one reference to a scientific paper as opposed to other reports and chapters of IPCC-AR5? (Lough, Janice, Australian Institute of Marine Science)
329	30	12	26	12	26	In place of "confidence," it would be preferable to use "likelihood" given that confidence is a separate metric within the uncertainties guidance. (Mach, Katharine, IPCC WGII TSU)
330	30	12	27	12	29	Were the relatively high rates of sea-level rise not in the early-mid Holocene? Also check references to correct figures and chapters in WG1 (Lough, Janice, Australian Institute of Marine Science)
331	30	12	31	12	31	Sealevel rise cannot be measured from bouys and floats, as you need full water column measurements of density. (UNITED STATES OF AMERICA)
332	30	12	37	12	37	very likely should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
333	30	12	37	12	38	A finding that includes a probabilistic measure of uncertainty does not require explicit mention of the level of confidence associated with that finding if the level of confidence is "high" or "very high" (UNITED STATES OF AMERICA)
334	30	12	41	12	41	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
335	30	12	41	12	41	likely should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
336	30	12	41	12	42	The combination of a likelihood statement and a confidence statement in one sentence appears to be in contradiction with the IPCC uncertainty guidance. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)

#	Ch	From Page	From Line	To Page	To Line	Comment
337	30	12	41	12	47	Reword to show uncertainty in SL projections. SL is likely to rise but the amounts given have large error bars. Is SL discussion needed in this chapter since it is covered elsewhere? (UNITED STATES OF AMERICA)
338	30	12	47	12	47	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
339	30	12	47	12	47	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
340	30	12	49	12	49	Is the use of "very likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
341	30	12	49	12	49	If being used as a likelihood term, "very likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)
342	30	12	50	12	50	The reference here is not clear. Does it include Figure 13.18? (Plattner, Gian-Kasper, IPCC WGI TSU)
343	30	12	51	12	51	topology, oceanography, and other factors topography (Christian, James, Government of Canada)
344	30	13	2	13	2	Is the use of "very likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
345	30	13	2	13	2	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
346	30	13	13	13	13	ocean mixing driven by wind ocean mixing and upwelling driven by wind (Christian, James, Government of Canada)
347	30	13	16	13	16	I can not tell what is meant by "ocean circulation measurements" here (Christian, James, Government of Canada)
348	30	13	16	13	17	Ocean observations do not limit our understanding . They increase it. This sentence should be reworded to indicate that more ocean observations are needed (as it is assumed that this is the authors' intention). (UNITED STATES OF AMERICA)
349	30	13	17	13	17	has changed over what period? Since observations have begun? Since industrialization? (UNITED STATES OF AMERICA)
350	30	13	21	13	22	low and "confidence" should be italicized on these lines for clarity. (Mach, Katharine, IPCC WGII TSU)
351	30	13	23	13	23	Wind stress (westerly winds) has increased since 1951 over the Southern Ocean should be "Wind stress over the Southern Ocean (westerly winds) has increased since 1951" or something else to avoid confusion that wind stress is being described that way globally. (UNITED STATES OF AMERICA)
352	30	13	32	13	37	Again, how about some primary literature references? (Lough, Janice, Australian Institute of Marine Science)
353	30	13	33	13	33	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
354	30	13	33	13	33	If being used as a likelihood term, "likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)
355	30	13	35	13	36	This sentence ("Understanding how.....") doesn't make sense grammatically (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
356	30	13	36	13	36	uncertain is not one of the official confidence summary terms. Please use IPCC uncertainty language or remove the italics. (UNITED STATES OF AMERICA)
357	30	13	36	13	36	uncertain is not a calibrated term within the uncertainties guidance, and therefore it should not be italicized. (Mach, Katharine, IPCC WGII TSU)
358	30	13	40	13	41	What does "consistent with Walker Circulation" mean? Do you mean a weakening of the WC? (Lough, Janice, Australian Institute of Marine Science)
359	30	13	40	30	40	Change "analyzes" to "analyses" (UNITED STATES OF AMERICA)
360	30	13	44	13	44	low and "agreement" should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
361	30	13	46	13	46	evidence from the tropical Pacific: how robust is this evidence, or how representative of a trend is it? Without this kind of information, this detail seems to be speculation. (UNITED STATES OF AMERICA)
362	30	13	48	13	48	If being used as a likelihood term, "likely" should be italicized for clarity. Casual usage should be avoided. (Mach, Katharine, IPCC WGII TSU)
363	30	13	48	13	50	ENSO is short-term, i.e. interannual rather than long-term variability. Also, what about PDO/IPO as sources of decadal variability? (Lough, Janice, Australian Institute of Marine Science)
364	30	13	52	13	52	ocean circulation (Lough, Janice, Australian Institute of Marine Science)

#	Ch	From Page	From Line	To Page	To Line	Comment
365	30	13	52	13	52	Is the use of "very likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
366	30	13	52	13	52	very likely should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
367	30	13	53	13	53	What is the meaning of strengthening of subtropical gyres? (UNITED STATES OF AMERICA)
368	30	14	0	0	0	Figure 30.6 "solar insolation" (Christian, James, Government of Canada)
369	30	14	1	14	1	limited evidence should be accompanied by a statement about level of agreement (UNITED STATES OF AMERICA)
370	30	14	2	14	2	rather abrupt change of topic here (Christian, James, Government of Canada)
371	30	14	3	14	3	large scale changes in wind --- qualify. How big? What are these changes? (UNITED STATES OF AMERICA)
372	30	14	9	14	37	There is no assessment in this section of Evidence/Confidence (Lough, Janice, Australian Institute of Marine Science)
373	30	14	11	14	25	There are no confidence statements in this paragraph. Please consider appropriate use of them in this section. (UNITED STATES OF AMERICA)
374	30	14	22	14	25	This statement should be qualified with a confidence or likelihood statement. (UNITED STATES OF AMERICA)
375	30	14	23	14	23	If being used as a likelihood term, "likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)
376	30	14	23	14	24	PDO is "decadal" not interannual. (Lough, Janice, Australian Institute of Marine Science)
377	30	14	25	14	25	This line seems contradictory given that some reasons are provided above. Rewrite to be more precise a summary of where knowledge gaps exist. (UNITED STATES OF AMERICA)
378	30	14	27	14	37	Is it possible to identify where the changes identified in the regression analyses in these figures are significant? This would contribute to "detecting" where significant changes have occurred in the oceans. (Lough, Janice, Australian Institute of Marine Science)
379	30	14	32	14	32	In the caption for figure 30-6, insert the word "Surface" so it reads "Surface salinity as the percentage change from....". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
380	30	14	42	14	42	Why not just call them "tropical cyclones". (Lough, Janice, Australian Institute of Marine Science)
381	30	14	43	14	43	The phrase "positive and negative influences" is vague. Does this mean good and bad? High and low? Please clarify. (UNITED STATES OF AMERICA)
382	30	14	46	14	47	De'ath et al (2012) do not provide evidence for coral reef recovery taking "decades". I am sure there must be other coral reef literature that can support this statement. (Lough, Janice, Australian Institute of Marine Science)
383	30	14	49	14	49	most intense cyclones => most intense tropical cyclones\n\n (NETHERLANDS)
384	30	14	49	14	53	Please use "tropical cyclones" to help distinguish from higher latitude "cyclones"; I think the conclusions from WG1 Ch 2 that there is no overall gobal trend in TC frequency discernible should be reiterated here; also make it clear that the Callaghan & Power (2011) refers to severe TCs (Lough, Janice, Australian Institute of Marine Science)
385	30	14	52	14	52	East Australian coast is the 19th century "is" should be changed to "since" (Head, Erica, Fisheries and Oceans Canada)
386	30	14	52	14	52	7th word in line should be "in" (Somero , George , Stanford University)
387	30	14	52	14	52	Is "in the 19th century" correct? Should this say "in the 20th century"? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
388	30	14	54	15	1	Need to justify this claim with a citation or by referring to another AR5 section. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
389	30	15	0	0	0	There is reference to a figure 30-16. However, there is no figure 30-16. It seems that the reference in the text should have been made to Box Figure 30-1. (UNITED STATES OF AMERICA)
390	30	15	4	15	4	is likely should be "are likely" (Head, Erica, Fisheries and Oceans Canada)

#	Ch	From Page	From Line	To Page	To Line	Comment
391	30	15	4	15	4	The chapter team should consider whether a level of confidence would be more appropriate here in place of the likelihood term used. (Mach, Katharine, IPCC WGII TSU)
392	30	15	4	15	11	There is inconsistent use of italics with likelihood statements. Please be consistent throughout the chapter to dinstiguish between formal IPCC uncertainty language and standard language. (UNITED STATES OF AMERICA)
393	30	15	5	15	5	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
394	30	15	5	15	5	If being used as a likelihood term, "likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)
395	30	15	6	15	7	frequency will decrease...likely to decrease repeats line 1. (UNITED STATES OF AMERICA)
396	30	15	7	15	7	Should be "numbers of extra-tropical and tropical storm events are likely" (Head, Erica, Fisheries and Oceans Canada)
397	30	15	7	15	7	If the 2nd "likely" on this line is being used as a likelihood term, it should be italicized. (Mach, Katharine, IPCC WGII TSU)
398	30	15	9	0	0	poleward [remove the "s"]. (UNITED STATES OF AMERICA)
399	30	15	9	15	9	medium confidence could be placed within parentheses at the end of the sentence to maximize clarity and directness of wording. (Mach, Katharine, IPCC WGII TSU)
400	30	15	10	15	10	Please check the reference to WGI, 3.4.5. Sec. 3.4.5 in WGI is about waves, not storm tracks, and about observations, so they cannot support the statement that storm tracks WILL shift poewards.\n\n (NETHERLANDS)
401	30	15	10	15	10	If being used as a likelihood term, "likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)
402	30	15	16	15	29	This section reiterates chapter 6 content. Is this necessary? (UNITED STATES OF AMERICA)
403	30	15	17	15	20	In high latitude, several studies pointed out the increse of primary production by light availability under the stonger stratification. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
404	30	15	18	15	19	What about increases in light availability to phytoplankton as mixed layer depth shoals (see 6.1.1.5)? (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
405	30	15	18	18	21	At the risk of repeating the comments I made about the paragraph in the executive summary on this same topic - "This in turn reduces the availability of inorganic nutrients and consequently limits primary production (medium confidence, 6.1.1, 6.2.21, 6.2.2.2.3). This has been observed in the STGs" These statements are not entirely correct. According to Saba et al. (2010), nutrient (0-150 m, nitrate + nitrite) levels increased at HOT and BATS between the late 1980s and mid-2000s, and primary production and chlorophyll concentrations also increased. It is the measurements of near-surface chlorophyll by remote-sensing and the estimates of primary production that are based on them that are showing decreases over the STGs. Thus, there is disagreement between trends in primary production depending on methodologies. As written in the Executive Summary of Chapter 6 (Page 4, Lines 33-35), "The direction, magnitude and regional differences of a change of NPP in the open ocean as well as in coastal waters have limited evidence and low agreement for a global decrease projected by 2100." There is also the discussion/justification in Chapter 6, Page 12, Lines 1- 14 (as discussed above) (Head, Erica, Fisheries and Oceans Canada)
406	30	15	18	18	21	So, I might change the Chapter 30 text to this (Head, Erica, Fisheries and Oceans Canada)
407	30	15	18	18	21	This in turn reduces the availability of inorganic nutrients, leading to decreased primary productivity (6.1.1.1, \n6.2.1.1, 6.2.3.3). In the STGs, which dominate the three major ocean basins, satellite derived estimates of surface chlorophyll and primary production decreased between 1999 and 2007 (6.1.3). By contrast, however, in situ observations at fixed stations in the North Pacific and North Atlantic STGs (HOT and BATS), showed increases in nutrient and chlorophyll levels and primary production over the same period, suggesting that at local scales other processes (e.g. ENSO, PDO, NAO, winds, eddies, advection) can counteract broad-scale trends. (Head, Erica, Fisheries and Oceans Canada)

#	Ch	From Page	From Line	To Page	To Line	Comment
408	30	15	24	15	25	It would be helpful to provide some extra details/citations regarding future stratification changes here, rather than exclusively referring to Chapter 6. For example Capotondi et al. [2012] or Sallée et al. (2013), JGR:Oceans [DOI: 10.1002/jgrc.20157]. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
409	30	15	24	15	25	Clear line of sight to the supporting assessment should be provided for this conclusion. (Mach, Katharine, IPCC WGII TSU)
410	30	15	25	15	27	Does the compensation occur as a global mean? It is unclear where the primary procutivity is compensated. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
411	30	15	33	0	0	I think it is better to insert the box to 30.3.1.3 Surface Wind and Ocean Circulation rather than 30.3.1.6 Thermal Stratification. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
412	30	15	33	16	5	Mendelssohn and Schwing (2002) demonstrated a strong relationship between trend in wind stress and SST in the California and Peru-Chile EBUEs on the sub-ecosystem scale, confirming the Bakun (1990) hypothesis and consistent with Garcia-Reyes and Largier (2010). Further, the subecosystem patterns correspond to the distribution of principal fisheries stocks, (Parrish et al. (1983), suggesting that these trends will have significant effects on those populations. Citations - Mendelssohn, R. and F.B. Schwing. 2002. Common and uncommon trends in SST and wind stress in the California and Peru-Chile Current Systems Progress in Oceanography 53: 141-162. Parrish, R.H., A. Bakun, D.M. Husby, and C.S. Nelson. 1983. Comparative climatology of selected environmental processes in relation to eastern boundary current fish production. FAO Fish Rep. 291:731-778. (UNITED STATES OF AMERICA)
413	30	15	36	0	0	Figure 30-16 does not exist. (Ingvaldsen, Randi, Institute of Marine Research)
414	30	15	36	15	36	I cannot find Figure 30-16. (Lough, Janice, Australian Institute of Marine Science)
415	30	15	40	0	0	I suggest to introduce changes in seasonality (frequency and intensity) of the upwelling events in their northen liomit (Canary current in the northen Iberian Peninsule) as is referred in: Llope, M., Anadón, R., Viesca, L., Quevedo, M., González-Quirós, R., Stenseth, N.C. 2006 Hydrography of the Southern Bay of Biscay shelf break region: integrating the multi-scale physical variability over the period 1993-2003. J. Geophys. Res. 111, C0921 (doi:10.1029/2005JC002963). (Anadon, Ricardo, University of Oviedo)
416	30	15	51	0	0	I suggest to incorporate to the paragraph the term curl upwellingdue to increasing importance to describe the biological responses to upwellings. References could be the Rykaczewski and Dunne but also the Pickett, M.H. and Schwing, F.B. 2006 Evaluating upwelling estimates off the west coast of North and South America. Fisheries Oceanogr. 13(3): 256-269 (Anadon, Ricardo, University of Oviedo)
417	30	16	5	16	5	Need to check consistency with chapter 6, which also talks about changes in ocean productivity. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
418	30	16	14	16	33	This is a good summary of salinity changes that draws on relevant recent research. (AUSTRALIA)
419	30	16	14	16	33	This section says nothing about salinity differences with depth, or the observed freshening of the deep ocean. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
420	30	16	18	16	18	I cannot find Figure 30-5D. (Lough, Janice, Australian Institute of Marine Science)
421	30	16	18	16	18	This sentence should reference figure 30.6D not 30.5D (UNITED STATES OF AMERICA)
422	30	16	18	16	20	The confidence metric is explicitly non-quantitative and thus "99%" should not be used here. The likelihood scale is quantitative and may be more appropriate. (Mach, Katharine, IPCC WGII TSU)
423	30	16	19	16	19	Incorrect use of confidence. Since a quantified value (99%) is given, then a likelihood statement should be applied. (UNITED STATES OF AMERICA)
424	30	16	31	16	31	temperature increases. (Lough, Janice, Australian Institute of Marine Science)

#	Ch	From Page	From Line	To Page	To Line	Comment
425	30	16	39	16	39	'decreased ocean pH as well as carbonate ion concentration' don't mention bicarbonate ion since this one increases its concentration (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
426	30	16	39	16	39	decreased ocean pH as well as carbonate and bicarbonate ion concentrations...This statement is incorrect. Under acidification bicarbonate increases. (UNITED STATES OF AMERICA)
427	30	16	39	16	39	why reduced bicarbonate ion? as CO2 is added, HCO3- goes up and CO3-- goes down (Christian, James, Government of Canada)
428	30	16	39	16	42	Consider fragmenting this phrase. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
429	30	16	39	16	42	For "The extent to which the added influx of CO2 into the Ocean has acidified and influenced the tendency for aragonite or calcite (polymorphs of calcium carbonate) to precipitate into the shells and skeletons of marine organisms depends mostly on the solubility of CO2 and calcium carbonate," perhaps rewrite to "... to precipitate into or dissolve the shells and skeletons..." or something similar to avoid confusion that added CO2 increases precipitation. The sentence as written is absolutely correct, just may not be understood correctly by non-experts. (UNITED STATES OF AMERICA)
430	30	16	40	16	40	delete "acidified and" (Christian, James, Government of Canada)
431	30	16	40	16	41	tencency for.... into the shells makes it sound as though calcification is a chemically spontaneous process, which it is not. Organisms exert different levels of biological control over the process. It is suggested that this passage be rewritten to encompass the notion that it might be harder for organisms to preciptate the minerals. (UNITED STATES OF AMERICA)
432	30	16	41	16	41	Calcite doesn't just "precipitate into shells" - see chapter 6, the deposition of calcium carbonate in shells requires complex physiological processes (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
433	30	16	42	16	42	….or depth INCREASES. Solubility of CaCO3 decreases with depth till no deposition below the Calcite Compensation Depth (as stated later) (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
434	30	16	43	16	45	Other factors.... Upwelling areas seems contradictory to the preceding sentence. (UNITED STATES OF AMERICA)
435	30	16	47	16	47	Suggest the authors cite Feely et al 2008; Gruber et al 2012; Hauri et al; 2013 (UNITED STATES OF AMERICA)
436	30	16	47	16	49	This statement should be revised. The averages given here do not properly indicate the large north-south and east-west gradients in saturation states in the North and South Pacific. (UNITED STATES OF AMERICA)
437	30	16	48	16	48	The ASH is much shallower than this in much of the Pacific. (Christian, James, Government of Canada)
438	30	16	49	16	49	Change to read "saturation horizon between 200 m and 2500 m in the Pacifc... (Orr et al., 2005; Feely et al., 2012). (UNITED STATES OF AMERICA)
439	30	16	49	16	49	See also The Oceanic Sink for Anthropogenic CO2, Christopher L. Sabine, Richard A. Feely, Nicolas Gruber, Robert M. Key, Kitack Lee, John L. Bullister, Rik Wanninkhof, C. S. Wong, Douglas W. R. Wallace, Bronte Tilbrook, Frank J. Millero, Tsung-Hung Peng, Alexander Kozyr, Tsueno Ono, and Aida F. Rios; Science 16 July 2004: 305 (5682), 367-371. [DOI:10.1126/science.1097403] (UNITED STATES OF AMERICA)
440	30	16	51	16	51	Surface Ocean pH has declined by 0.122 unit for mean Ocean seawater (+32.4% more proton H+ concentration) since… (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
441	30	16	52	16	53	Why use "Very High Confidence" here when WG1 Ch3 uses "very likely"? Please be consistent. (UNITED STATES OF AMERICA)
442	30	16	52	16	53	significant shoaling of the saturation horizons of both polymorphs of calcium carbonate. Orr et al show data only for aragonite and do not demonstrate that the preindustrial-present difference is significant. (Christian, James, Government of Canada)
443	30	16	54	16	54	...-0.0015 to -0.0024 (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
444	30	16	54	16	54	Change to read -0.0014 and -0.0024 pH units per year; WG1 3.8.2, Table 3.2). (UNITED STATES OF AMERICA)
445	30	17	1	17	1	Change to read (WG1 3.8.2, Figure 3.18) (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
446	30	17	1	17	3	The syntax of this statement is ambiguous, in that it seems the latter part of the sentence ("at least 10 times faster than accumulation of atmospheric CO2 during the PETM") is referring to recent increases in atmospheric CO2 rather than to "these changes," which presumably are decline in ocean pH and saturation state. (Mach, Katharine, IPCC WGII TSU)
447	30	17	2	17	2	at least 10-100 faster (CO2 rise happened in 10-20 000 years) (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
448	30	17	5	17	6	current chemistry of the ocean is outside where it has been for million years is too vague a statement. Level of agreement with this statement has not been summarized. Please provide detail to clarify. (UNITED STATES OF AMERICA)
449	30	17	6	17	6	should the word "many" (or something equivalent) be the first word in this line; something seems needed before "millions". (Somero , George , Stanford University)
450	30	17	6	17	6	millions' in plural and, in addition to Pelejero et al., 2012 and Zeebe et al., 2012, you can also add Hönisch et al., 2012 as a reference (Hönisch, B., Ridgwell, A., Schmidt, D.N., Thomas, E., Gibbs, S.J., Sluijs, A., Zeebe, R., Kump, L., Martindale, R.C., Greene, S.E., Kiessling, W., Ries, J., Zachos, J.C., Royer, D.L., Barker, S., Marchitto Jr., T.M., Moyer, R., Pelejero, C., Ziveri, P., Foster, G.L., Williams, B., 2012. The geological record of ocean acidification. Science 335, 1058-1063.) (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
451	30	17	6	17	6	After "years", add "and many organisms demonstrate negative responses to ocean acidification" to show the total motivation for concern. (UNITED STATES OF AMERICA)
452	30	17	6	17	8	This statement should be qualified with a confidence or likelihood statement (UNITED STATES OF AMERICA)
453	30	17	6	17	8	The citations of Hogh-Guldberg and Raven are certainly not the best ones. Consider:\nCaldeira K. & Wickett M. E., 2003. Anthropogenic carbon and ocean pH. Nature 425:365.\nZeebe R. E. & Ridgwell A., 2011. Past changes of ocean carbonate chemistry. In: Gattuso J.-P. & Hansson L. (Eds.), Ocean acidification, pp. 21-40. Oxford: Oxford University Press. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
454	30	17	8	17	8	possibly 300 million years outside the asteroidal Cretaceous/Tertiary event. (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
455	30	17	14	17	18	This contradicts chapter 6 where confidence in biological responses is judged as being low, because of huge variability in responses among species and strains of similar organisms. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
456	30	17	14	17	20	Munday et al (2008) Climate change and the future for coral reef fishes. Fish & Fisheries 9, 261-285 is a useful review. (Lough, Janice, Australian Institute of Marine Science)
457	30	17	15	0	0	Is it justified to cite two papers from one of the CLAs to support this statement? Many others could be cited, among which:\nManzello D. P., Kleypas J. A., Budd D. A., Eakin C. M., Glynn P. W. & Langdon C., 2008. Poorly cemented coral reefs of the eastern tropical Pacific: possible insights into reef development in a high-CO2 world. Proceedings of the National Academy of Science U.S.A. 105:10450-10455.\nAndersson A. J. & Gledhill D., 2013. Ocean acidification and coral reefs: effects on breakdown, dissolution, and net ecosystem calcification. Annual Review of Marine Science 5:321-348. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
458	30	17	19	17	20	Please consider replacing the wording 'there are a growing …processes that' by 'a growing number of organisms and processes'.\n\n (NETHERLANDS)
459	30	17	22	17	25	Specify in the surface ocean, the deep ocean will experience much smaller changes. (UNITED STATES OF AMERICA)
460	30	17	22	17	31	This might be also an issue with WG1, but it would be good to include more results from the CMIP5 ESMs. E.g. Bopp et al, 2013, BGD (doi:10.5194/bgd-10-3627-2013) have looked at future ocean acidification and deoxygenation in the CMIP5 models. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)

#	Ch	From Page	From Line	To Page	To Line	Comment
461	30	17	22	17	31	The following, more recent, paper of the same author would provide better estimates. Orr J. C., 2011. Recent and future changes in ocean carbonate chemistry. In: Gattuso J.-P. & Hansson L. (Eds.), Ocean acidification, pp. 41-66. Oxford: Oxford University Press. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
462	30	17	23	0	0	Doubling with respect to which value/year? (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
463	30	17	23	17	23	The baseline for "doubling CO2" could be clarified--compared to preindustrial? (Mach, Katharine, IPCC WGII TSU)
464	30	17	23	17	24	Doubling CO2 to 540 ppm will decrease pH by another 0.12 unit (+73% proton H+ concentration). (Pecheux, Martin, Institut des Foraminifères Symbiotiques)
465	30	17	24	17	24	Units on 100 mmol kg-1 are wrong. These units should be µmol kg-1. (UNITED STATES OF AMERICA)
466	30	17	24	17	24	mmol/kg (two times) (Christian, James, Government of Canada)
467	30	17	25	17	26	This sentence is confusing. The trends in the saturation state migration vary significantly in both the north-south and east-west directions (see Feely et al., 2012). (UNITED STATES OF AMERICA)
468	30	17	27	17	27	See also The Oceanic Sink for Anthropogenic CO2, Christopher L. Sabine, Richard A. Feely, Nicolas Gruber, Robert M. Key, Kitack Lee, John L. Bullister, Rik Wanninkhof, C. S. Wong, Douglas W. R. Wallace, Bronte Tilbrook, Frank J. Millero, Tsung-Hung Peng, Alexander Kozyr, Tsueno Ono, and Aida F. Rios; Science 16 July 2004: 305 (5682), 367-371. [DOI:10.1126/science.1097403] (UNITED STATES OF AMERICA)
469	30	17	28	17	28	more rapid onset of undersaturation in high latitudes is partially, but not entirely, due to temperature (Christian, James, Government of Canada)
470	30	17	28	17	29	The trends in aragonite undersaturation are different within each polar region (see Steinacher et al., 2009). If polar saturation states are discussed in the chapter, then the authors should consider adding some detail to clarify. (UNITED STATES OF AMERICA)
471	30	17	29	17	31	Maybe this 'likely' in the phrase should be relaxed a bit in view of the recent experimental findings regarding experiments with cold water corals such as the work by Maier et al., 2013 (Maier, C., Schubert, A., Berzunza Sànchez, M.M., Weinbauer, M.G., Watremez, P., Gattuso, J.-P., 2013. End of the century pCO2 levels do not impact calcification in Mediterranean cold-water corals. PLoS ONE 8, e62655.)\n (Peleiero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
472	30	17	29	17	31	However other studies found deep water corals robust to OA (see citations in Chapter 6). (UNITED STATES OF AMERICA)
473	30	17	30	17	30	very likely seems to be an overstatement... that assumes 90-100% confidence? We don't know how strongly deep water communities depend on corals vs. other substrates for habitat. (UNITED STATES OF AMERICA)
474	30	17	34	17	38	The Arctic Ocean is completely missing in these plots yet the text includes some discussion of Arctic Ocean saturation states. While this may be addressed in the Polar Chapter, it would be valuable to include here (or at least reference the pertinent sections) for context. Suggest using the plots from Feely et al. (2009). The chapter text briefly discusses Arctic, but by excluding the polar regions from figures (Fig. 30-7), there is an inconsistency in the chapter. (UNITED STATES OF AMERICA)
475	30	17	41	17	41	Note, unless the water parcel is at the surface, changes in solubility cannot change the concentration of a gas in water. (UNITED STATES OF AMERICA)
476	30	17	41	18	48	Section 30.3.2.3 is poorly/illogically organized. Reorganization is needed. (UNITED STATES OF AMERICA)
477	30	17	46	17	47	Long term records of oxygen are also available for the North Pacific (Whitney et al. [2007] and Ono et al [2001]) and show long term secular decreases in oxygen. Suggest to include these results here. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)

#	Ch	From Page	From Line	To Page	To Line	Comment
478	30	17	46	17	47	The authors mentioned "Long-term records of oxygen concentration in ocean waters are rare". But after that the authors showed oxygen data since 1960 as an example of long data. However, there are many data as long as such data. For example, Aoyama et al. (2008) Marine biogeochemical response to a rapid warming in the main stream of the Kuroshio in the western North Pacific. Fisheries Oceanography, 17, 206-218. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
479	30	17	47	17	47	high agreement should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
480	30	17	49	17	54	Work has been done by Andrews et al. [2013], BG [doi:10.5194/bg-10-1799-2013] demonstrating that an external influence on recent changes in oceanic oxygen is detectable using an optimal fingerprinting method. This should be included as further support for a climate-driven component to historical changes in oceanic oxygen. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
481	30	17	52	17	53	phenomenon....change. seems to contradict the statement in line 48. (UNITED STATES OF AMERICA)
482	30	18	4	18	4	It could be helpful to indicate more precisely what waters are defined as "deep." (Mach, Katharine, IPCC WGII TSU)
483	30	18	4	18	4	Usually, likelihood assignments are associated with high confidence, which is not the case here--the logic here needs further explanation. This may be a situation where a confidence statement is more appropriate. (Mastrandrea, Michael, IPCC WGII TSU)
484	30	18	4	18	7	Confidence statements in this sentence seem contradictory (limited evidence, medium agreement -> high confidence?) (UNITED STATES OF AMERICA)
485	30	18	6	18	9	This idea is repeated many times elsewhere. Shorten or cut. (UNITED STATES OF AMERICA)
486	30	18	12	18	14	I agree that the subarctic Pacific is a region where the physical forcings of deoxygenation are beginning to be understood, but I wouldn't assume that Nakanowatari et al's hypothesized mechanisms are the final word on this. (Christian, James, Government of Canada)
487	30	18	16	18	41	There is no agreement between units for O2. Should be micromoles per kg. (UNITED STATES OF AMERICA)
488	30	18	17	18	17	Are "Black and Baltic Seas" an example of SES or are these the SES in which the development of hypoxic conditions is observed? \n\n (NETHERLANDS)
489	30	18	23	18	23	pO2 should have pressure units and cannot be converted to concentration unless temperature is known. (UNITED STATES OF AMERICA)
490	30	18	23	18	23	mg/L should be ml/L? (Christian, James, Government of Canada)
491	30	18	27	18	27	It would be helpful to indicate more precisely what is meant by "threatened." (Mach, Katharine, IPCC WGII TSU)
492	30	18	30	18	32	The calculation... and/or temperature makes no sense and seems out of place. (UNITED STATES OF AMERICA)
493	30	18	32	18	32	Casual usage of "likely" should be avoided as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
494	30	18	37	18	38	This sentence is repetitive. (UNITED STATES OF AMERICA)
495	30	18	47	18	48	Why is the Gulf of Mexico not shown in this figure? Seems like a large omission. (UNITED STATES OF AMERICA)
496	30	18	51	0	0	It seem strange that the 30.4 only explains the result of Poloczanska et al. 2013. That is very good paper but the fact the whole section was occupied by one literature seems strange. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
497	30	18	51	18	52	It is unlcear as to why ocean acidification is specifically called out in this section as opposed to other responses by marine organisms to climate change (changing megafauna migration pattersn due to warming/shifting ocean physics, shifts in timing of spawning, etc.) (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
498	30	19	1	0	0	This section heavily relies on a paper submitted (Poloczanka et al.), not published in 2013 as indicated in the citations. This section cannot be properly evaluated as the manuscript is not available to reviewers of this chapter. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
499	30	19	16	19	16	consistent with climate change - What does this mean? What the expected response is? Who determines what is expected? Is this an objective determination? NOTE - this comment also applies to lines 25 and 32. (UNITED STATES OF AMERICA)
500	30	19	16	19	16	Is there a way to connect the blue-red-yellow system with IPCC confidence scheme? (UNITED STATES OF AMERICA)
501	30	19	21	19	21	Should be the "North-west Atlantic (Poloczanska et al. 2013)" (Head, Erica, Fisheries and Oceans Canada)
502	30	19	37	19	37	The overall mean rate of re-distribution I would specify latitudinal redistribution. This new topic sort of comes out of the blue and could use an introductory sentence or two. (Christian, James, Government of Canada)
503	30	19	37	19	44	Needs to cross reference to chapter 6 where there is a similar description of range shifts, although using different datasets/analyses (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
504	30	19	41	19	44	State what the positive/negative value for spring timing means (later/earlier). (UNITED STATES OF AMERICA)
505	30	19	43	19	44	data or literature reference needed here (Christian, James, Government of Canada)
506	30	19	49	19	49	extra text 'O (brown)' in figure caption. (UNITED STATES OF AMERICA)
507	30	19	53	19	53	There are no asterisks in the figure but the figure caption implies they should be in the figure. (UNITED STATES OF AMERICA)
508	30	20	3	20	3	Direction is needed to go with 'velocity', which is speed + direction. NOTE this comment also applies to line 8. (UNITED STATES OF AMERICA)
509	30	20	3	20	3	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
510	30	20	12	20	12	diagnostic fingerprints = ? It is unclear as to what these are. Explanation is needed. (UNITED STATES OF AMERICA)
511	30	20	12	20	12	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
512	30	20	21	0	0	30.5. Authors should consider refering to other regional chapters of WG2 (ch 22-29) where ocean issues have been dealt with. (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)
513	30	20	31	0	0	Section 30.5.1. This section should be reduced in length as much as possible. (Mach, Katharine, IPCC WGII TSU)
514	30	20	32	0	0	35 degrees seems mid-latitude, definition of the regions might be strengthened throughout. (UNITED STATES OF AMERICA)
515	30	20	44	23	20	strong overlap with ch6. Box 6-1 The Atlantic Example: Long-Term Responses of Pelagic Organisms and Communities to Temperature. Needs balancing in order to avoid redundancies in the two chapters (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)
516	30	20	47	20	47	Should be "North American" not "American." (UNITED STATES OF AMERICA)
517	30	20	53	0	0	Considering the warming of the North Atlantic HLSBS: It should be stated explisity that this statement applies for the surface. Most of the North Atlantic HLSBS is sub-surface, and the temperature increase below surface is substantially weaker. (Ingvaldsen, Randi, Institute of Marine Research)
518	30	20	54	21	1	It is stated that from 1970 Atlantic Ocean is the basin which warmed more (0.3 referencing to table 30-2). However, checking the table the North Pacific warmed 0.38 0/decade. It seems that the table is based in data dating from 1955. Which might explain but gets pretty confusing. \n\n (NETHERLANDS)
519	30	21	4	21	5	This statement would be strengthened by a confidence estimate. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
520	30	21	12	21	12	Insert Genner at al., 2004, 2010\nGenner MJ, Sims DW, Wearmouth VJ, Southall EJ, Southward AJ, Henderson PA, Hawkins SJ. 2004. Regional climatic warming drives long-term community changes of British marine fish. Proceedings of the Royal Society of London, Biological Sciences 271: 655-661.\n\nGenner MJ, Sims DW, Southward AJ, Budd GC, Masterson P, Mchugh M, Rendle P, Southall EJ, Wearmouth VJ, Hawkins SJ. 2010. Body size-dependent responses of a marine fish assemblage to climate change and fishing over a century-long scale. Global Change Biology 16: 517-527.\n (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
521	30	21	19	21	40	This passage seems unduly detailed. It is recommended that the passage be condensed. (UNITED STATES OF AMERICA)
522	30	21	27	21	27	The timeframe of the "recent warming period" should be specified. During the 1980s? (Mach, Katharine, IPCC WGII TSU)
523	30	21	27	21	28	Considering the feeding distribution of blue whiting, it is worth mentioning that the stock increased during the same period. When the stock size decreased the whiting disappeared from the Barents Sea, despite high temperatures in the resent years. (Ingvaldsen, Randi, Institute of Marine Research)
524	30	21	28	21	28	Blue whiting (Micromesistius poutassou) is a different species to whiting (Merlangus merlagius) so the authors need to be careful here. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
525	30	21	30	21	34	It is stated that the zooplankton production in the Barents Sea will increase by 20% by 2100. This applies only for the Atlantic zooplankton production and should be stated. In addition the following result coming from the same publication should be included: "At the same time, Arctic zooplankton is projected to decrease significantly (50%) causing the total Barents Sea production to decrese (Ellingsen et al., 2008)." (Ingvaldsen, Randi, Institute of Marine Research)
526	30	21	31	21	31	Virtually certainly going to is inconsistent terminology (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
527	30	21	31	21	33	For the projection given, it would be preferable to specify the relevant scenario of climate change and baseline for the percentage increase provided. (Mach, Katharine, IPCC WGII TSU)
528	30	21	34	21	35	This statement from Cheung et al. [2011] (projecting increases in fish biomass and catch in the N. E. Atlantic) is high impact and 'very likely'. As such, I suggest this point by including it in the Executive Summary (Page 5, Line 5). (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
529	30	21	34	21	37	It is stated that substantial increases in fish biomass and catch is very likely, and in the next sentence it is stated that discountinous changes in life cycles conditions of fish like capelin is very likely. If it is VERY LIKELY with discontinous changes for important species, how can it be VERY LIKELY with substantial increases in biomass and catch of the species depending on them? A very likely substantial increase in biomass and catch is also not entirely consistent with the statement on p.50, line 33 stating that the abundance of fish (mostly boreal species) MAY INCREASE. (Ingvaldsen, Randi, Institute of Marine Research)
530	30	22	1	22	2	high confidence could be placed within parentheses at the end of the statement to maximize clarity and directness of wording. Additionally, it would be preferable to specify the general time frame for the observation. (Mach, Katharine, IPCC WGII TSU)
531	30	22	1	22	4	Replace "in the North Sea is" with in the North Sea are". Replace "Phenological responses of zooplankton were" \nwith "Phenological responses of zooplankton have been" (Head, Erica, Fisheries and Oceans Canada)
532	30	22	5	22	5	Replace "it's" with "its" (Head, Erica, Fisheries and Oceans Canada)
533	30	22	5	22	5	replace “it’s” with “its” (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
534	30	22	6	22	8	does not state whether change in meroplankton phenology has actually been observed (Christian, James, Government of Canada)

#	Ch	From Page	From Line	To Page	To Line	Comment
535	30	22	29	22	29	Insert Genner at el., 2004, 2010\nGenner MJ, Sims DW, Wearmouth VJ, Southall EJ, Southward AJ, Henderson PA, Hawkins SJ. 2004. Regional climatic warming drives long-term community changes of British marine fish. Proceedings of the Royal Society of London, Biological Sciences 271: 655-661.\n\nGenner MJ, Sims DW, Southward AJ, Budd GC, Masterson P, Mchugh M, Rendle P, Southall EJ, Wearmouth VJ, Hawkins SJ. 2010. Body size-dependent responses of a marine fish assemblage to climate change and fishing over a century-long scale. Global Change Biology 16: 517-527.\n (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
536	30	22	34	22	34	Insert "northward" thus "has been contracting northward at a rate of" (Head, Erica, Fisheries and Oceans Canada)
537	30	22	42	22	43	Line 43 Genner et al., 2010 separated out fishing impacts from climate \nGenner MJ, Sims DW, Southward AJ, Budd GC, Masterson P, Mchugh M, Rendle P, Southall EJ, Wearmouth VJ, Hawkins SJ. 2010. Body size-dependent responses of a marine fish assemblage to climate change and fishing over a century-long scale. Global Change Biology 16: 517-527.\n (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
538	30	22	44	22	44	Replace "this region" with "the North-east Atlantic" (Head, Erica, Fisheries and Oceans Canada)
539	30	22	45	22	48	How is "long" defined here for the "long-term data sets," and over what time frame where they collected? (Mach, Katharine, IPCC WGII TSU)
540	30	22	50	22	50	ICES Working Groups. Here the "ICES" abbreviation should be explained, i.e. "International Council for the Exploration of the Sea" (ICELAND)
541	30	23	1	23	20	This long term perspective is very interesting and relevant, however I think it needs to be revised to make the key message of competing natural and anthropogenic forcings more clear. Also some phrasing changes: " […] an almost similar large-scaled temperature increases […]". (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
542	30	23	1	23	20	General comment – There was much discussion by Cushing, Dickson, Colebrook, Russell, Southward about climate fluctuations in the 1970s and 1980s. This is often forgotten by the younger authors. (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
543	30	23	1	23	20	This paragraph seems to need to be split up and interspersed elsewhere, with repetitive bits taken out. (UNITED STATES OF AMERICA)
544	30	23	4	23	5	Another long-term study that could be cited is Engelhard et al. (2011) – ICES Journal of Marine Science, 68: 1090–1104. This is mentioned in chapter 6. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
545	30	23	7	23	7	Insert Hawkins et al., 2003 and Southward et al., 2005 \nHawkins SJ, Southward AJ, Genner MJ. 2003. Detection of environmental change in a marine ecosystem – evidence from the western English Channel. Science of the Total Environment 310: 245-246. \n\nSouthward AJ, Langmead O, Hardman-Mountford NJ, Aiken J, Boalch GT, Dando PR, Genner MJ, Joint I, Kendall M, Halliday NC, et al. 2005. Long-term oceanographic and ecological research in the Western English Channel. Advances in Marine Biology 47: 1-105.\n (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
546	30	23	7	23	9	Replace "The major lesson etc." with "The most important lesson from these reports is that in the high-latitude \nNorth Atlantic there was a large-scale temperature increase between the 1910s and 1940s that was similar to the one of the last 30 years that had similar basin-scale impacts on marine ecosystems." (Head, Erica, Fisheries and Oceans Canada)
547	30	23	11	23	12	Replace "has unfortunately discontinued." with "was unfortunately discontinued." (Head, Erica, Fisheries and Oceans Canada)
548	30	23	11	23	12	"…long term cooling in the 1960s/1970s" delete "impacts has" and replace with "responses". See Southward 1980\nSouthward, AJ. 1980. The Western English Channel – an inconstant ecosystem? Nature 258: 361-366.\n (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
549	30	23	11	23	20	A figure supporting this could be helpful. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
550	30	23	11	23	20	These statements should be deleted, as there are no citations provided and they are overly editorializing. (Mach, Katharine, IPCC WGII TSU)
551	30	23	12	23	14	centennial-long.... over the next... doesn't seem to make a lot of impact. It makes it sound as though shorter term variability is simply masking the signal. This point is made elsewhere. (UNITED STATES OF AMERICA)
552	30	23	20	23	20	Replace "recorded" with "before" (Head, Erica, Fisheries and Oceans Canada)
553	30	23	23	23	23	Section 30.5.1.1.2 needs certainty language (UNITED STATES OF AMERICA)
554	30	23	27	23	27	Presumably "average sea surface temperature" is meant?? (Mach, Katharine, IPCC WGII TSU)
555	30	23	30	23	30	The source reference for the NPGO is - Di Lorenzo E., Schneider N., Cobb K. M., Chhak, K, Franks P. J. S., Miller A. J., McWilliams J. C., Bograd S. J., Arango H., Curchister E., Powell T. M. and P. Rivere, 2008: North Pacific Gyre Oscillation links ocean climate and ecosystem change. Geophys. Res. Lett., 35, L08607, doi:10.1029/2007GL032838. (UNITED STATES OF AMERICA)
556	30	23	40	23	40	Replace "are" with "were" (Head, Erica, Fisheries and Oceans Canada)
557	30	23	42	23	42	Should state 'these chages indicate how' not 'indicate of how'. (UNITED STATES OF AMERICA)
558	30	23	44	23	44	It may be preferable to use "regime shifts" here rather than "climate regime shifts" in accord with terminology use elsewhere in the report. (Mach, Katharine, IPCC WGII TSU)
559	30	23	51	24	2	Section 30.5.1.1.2 does not include the issue of current speed of the gyres. Many of small pelagic fish spawns in the upstream of the Kuroshio and spread out to the offshores and the North Pacific HLSBS. The current speed change is important issue for their recruitment (e.g. Pacific saury: Ito S., H. Sugisaki, A. Tsuda, O. Yamamura and K. Okuda, 2004, Contributions of the VENFISH program: meso-zooplankton, Pacific saury (Cololabis saira) and walleye pollock (Theragra chalcogramma) in the northwestern Pacific, Fish. Oceanogr., 13. Suppl. 1, 1-9). Additionally, Sakamoto et al. (2005) detected enhancement of Kuroshio from the data and predicted futher intensification under global warming. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
560	30	24	9	24	9	There is more recent work which builds on Gillett et al. [2003] with regard to the detection and attribution of changes in Sea Level Pressure (SLP; as reviewed in WG1 Ch10 Sect. 10.3.3.4). (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
561	30	24	27	24	30	The two halves of this sentence don't go together. Suggest that they be split apart or that the sentence be revised. (UNITED STATES OF AMERICA)
562	30	24	31	24	31	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
563	30	24	48	24	49	high confidence could be placed within parentheses at the end of the statement for clarity and directness of wording. (Mach, Katharine, IPCC WGII TSU)
564	30	25	1	25	3	very high confidence could be placed within parentheses at the end of the sentence to maximize clarity and directness of wording. (Mach, Katharine, IPCC WGII TSU)
565	30	25	3	25	3	Consider including mention of the impacts of ocean acidification on pteropods using Bednarsek et al. (2012) as an exanple. (UNITED STATES OF AMERICA)
566	30	25	12	25	12	Is it possible to indicate more precisely what is meant by "even modest warming"--what levels of time change, what time frames? (Mach, Katharine, IPCC WGII TSU)
567	30	25	12	25	14	What is the basis for this statement? A direct connection between this statement and the scientific results reported is unclear. (UNITED STATES OF AMERICA)
568	30	25	12	25	18	This passage is choppy and vague. Please reconsider it. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
569	30	25	18	25	20	In basic, decrease in primary production connects to the decrease of fish production. But in some case it does not occur. For example, Okunishi et al. (2012) projected the compensation of food limitation by the farther north migration by Japanese sardine. Moreover, Ito et al. (2010) and Ito et al. (accepted) projected increase of egg production because of migration route change which is triggered by the food limition. So, fish response is much more complex. This kind of issue must be denoted.\nOkunishi T., S. Ito, T. Hashioka, T. T. Sakamoto, N. Yoshie, H. Sumata, Y. Yara, N. Okada, Y. Yamanaka, 2012, Impacts of climate change on growth, migration and recruitment success of Japanese sardine (Sardinops melanostictus) in the western North Pacific, Climatic Change, 3-4, 485-503, DOI 10.1007/s10584-012-0484-7.\nIto S., K. A. Rose, A. J. Miller, K. Drinkwater, K. M. Brander, J. E. Overland, S. Sundby, E. Curchitser, J. W. Hurrell and Y. Yamanaka, 2010, Ocean ecosystem responses to future global change scenarios: A way forward, In: M. Barange, J.G. Field, R.H. Harris, E. Hofmann, R. I. Perry, F. Werner (Eds) Global Change and Marine Ecosystems. Oxford University Press., 287-322, pp440.\nIto S., T. Okunishi, M.J., Kishi, M. Wang, 2013, Modeling ecological responses of Pacific saury (Cololabis saira) to future climate change and its uncertainty, accetped to ICES Journal of Marine Science. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
570	30	25	19	25	19	The changes documented by Behrenfeld et al are based on only ~10 years of data and are almost entirely driven by tropical (ENSO) variability. They are not a good analogue for the sort of mid-latitude stratification changes expected under AGW. I know B06 make this claim but their data do not support it. (Christian, James, Government of Canada)
571	30	25	20	25	21	Onset of spring warming information is repetitive with other sections. The should consider an approach to deling with information that is common to multiple regions without being overly repetitive. (UNITED STATES OF AMERICA)
572	30	25	20	25	21	The timeframe for this observed trend should be specified. (Mach, Katharine, IPCC WGII TSU)
573	30	25	44	25	44	Sections 30.5.2 and 30.5.2.1 need uncertainty language. (UNITED STATES OF AMERICA)
574	30	25	54	26	5	Make it clear that these changes in upwelling with ENSO refer to the Pacific. (Lough, Janice, Australian Institute of Marine Science)
575	30	26	0	0	0	There is reference to figure 30-12 in this section. However, this figure is not inserted until page 35. Figure should be inserted in the section in which it is first refereneced. (UNITED STATES OF AMERICA)
576	30	26	8	26	9	It would be useful to include a sentence upfront to differentiate equatorial upwelling systems from eastern boundary ecosystems , as this is not immediately obvious until later. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
577	30	26	14	26	15	What does "spatial variation in SST" mean and why is it related to ENSO Modoki? Unclear. (Lough, Janice, Australian Institute of Marine Science)
578	30	26	43	26	43	What are the uncertainties/ranges for these values? (Mach, Katharine, IPCC WGII TSU)
579	30	26	46	26	47	Further increases... further Is this true in both basins on a near-term timescale? Perhaps some comment about timing is warranted. The upwelling of low-pH water in the Pacific Northwest had to do with the local physics rather than penetration of anthropogenic CO2 to deep waters. (UNITED STATES OF AMERICA)
580	30	27	11	27	12	The statement that fisheries supported by Equatorial Upwelling Regions (EUS) will experience increased vulnerability is an important one Further elaboration on this point and an associated uncertainty level for these projections would be helpful. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
581	30	27	17	27	17	a subset (Somero , George , Stanford University)
582	30	27	17	27	17	Should be 'a subset' not 'an subset' (UNITED STATES OF AMERICA)
583	30	27	19	27	19	Further qualification of "significant" may be appropriate here given that 3.3% of global production does not seem a huge sum--significant recognizing the small area of these water bodies? (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
584	30	27	19	30	19	The text should read "support significant fisheries". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
585	30	27	38	27	38	low agreement should be used here in place of "limited agreement." (Mach, Katharine, IPCC WGII TSU)
586	30	27	42	27	42	Insert thus "loss of fish species that eat coral-associated invertebrates while herbivores" (Head, Erica, Fisheries and Oceans Canada)
587	30	28	5	28	5	Does "coral size" refer to colony size or polyp size, this isn't clear from the text. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
588	30	28	6	28	6	moderate confidence should be "medium" to follow IPCC standards. (UNITED STATES OF AMERICA)
589	30	28	7	0	0	Should the mechanism by which the decline in coral size is connected to heat-mediated bleaching be mentioned? (UNITED STATES OF AMERICA)
590	30	28	10	28	10	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
591	30	28	10	28	10	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. If being used as a likelihood term, "very likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)
592	30	28	13	28	13	The scenario of climate change for this projection should be specified. (Mach, Katharine, IPCC WGII TSU)
593	30	28	13	28	14	Will need to check about status of this paper as not sure whether it has been resubmitted yet. (Lough, Janice, Australian Institute of Marine Science)
594	30	28	29	28	29	The text should read "Temperatures in the surface waters of the Black Sea...". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
595	30	28	29	28	29	For the described temperature increase, is it possible to indicate the uncertainties/range for the estimate? (Mach, Katharine, IPCC WGII TSU)
596	30	28	36	28	36	The timeframe over which this change occurred should be specified. (Mach, Katharine, IPCC WGII TSU)
597	30	28	51	28	51	For the described temperature increase, is it possible to indicate the uncertainty/range for the estimate? (Mach, Katharine, IPCC WGII TSU)
598	30	29	8	29	8	Possibly edit the text to read "in the deeper basins (in particular the Bornholm Basin), producing conditions..." (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
599	30	29	11	29	12	“The decrease in phytoplankton and abundance and primary productivity since 1978 is very likely to be a response to increasing sea temperature (Madsen and Hojerslev, 2009),.....”. To my knowledge the study of Madsen and Hojerslev does not report any results on phytoplankton and primary productivity as a response to sea temperature and it is unclear what this statement is based upon. I cannot see that chapter 30 provide any published evidence for linking reduced primary production in the Baltic Sea or elsewhere with increased temperature. (Aksnes, Dag Lorents, University of Bergen)
600	30	29	12	29	12	Is the use of "very likely" here linked to a probability? If so, it should be italicized. NOTE - the same comment also applies to line 27 on this page. (UNITED STATES OF AMERICA)
601	30	29	12	29	12	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
602	30	29	12	29	13	very likely... almost certainly played a role seems nearly contradictory. Revise to show better what role decreased nutrients may have played relative to the magnitude of the response from temperature. (UNITED STATES OF AMERICA)
603	30	29	27	29	27	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
604	30	29	32	29	32	Section 30.5.3.1.5 lacks confidence estimates in several places (e.g. sea level rise point in line 52, increasing possibility of disease organisms, p. 30, line 9, and ecosystem changes cited on page 29, lines 37-39) (UNITED STATES OF AMERICA)
605	30	29	34	29	35	For the described temperature increase, is it possible to indicate the uncertainties/range for the estimate? (Mach, Katharine, IPCC WGII TSU)
606	30	29	38	29	38	Close parenthesis after references. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)

#	Ch	From Page	From Line	To Page	To Line	Comment
607	30	29	40	29	40	It is Vargas-Yáñez (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
608	30	29	40	29	41	Natural... trend This idea is repeated many times elsewhere. Find a way to deal with issues that affect many areas consistently. (UNITED STATES OF AMERICA)
609	30	29	52	29	52	It is Jordà (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
610	30	30	10	30	10	It is Sabatés (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
611	30	30	11	30	11	Should be Serrano et al., 2013 (Serrano, E., Coma, R., Ribes, M., Weitzmann, B., García, M., Ballesteros, E., 2013. Rapid northward spread of a zooxanthellate coral enhanced by artificial structures and sea warming in the Western Mediterranean. PLoS ONE 8, e52739. doi:52710.51371/journal.pone.0052739.\n (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
612	30	30	15	30	15	Replace "the spread of tropical invasive species from the eastern Mediterranean basin" with "the spread of tropical \ninvasive species into the eastern Mediterranean basin" (Head, Erica, Fisheries and Oceans Canada)
613	30	30	24	30	25	Delete "during events such as those in 1999, 2003 and 2006 in the Mediterranean" as this repeats text in the same paragraph. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
614	30	30	27	30	27	Is the use of "very likely" here linked to a probability? If so, it should be italicized. NOTE - the same comment also applies to page 31, line 14. (UNITED STATES OF AMERICA)
615	30	30	27	30	27	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. If being used as a likelihood term, "very likely" should be italicized. (Mach, Katharine, IPCC WGII TSU)
616	30	30	30	30	39	It is true that there are few studies of the impact of ocean acidification in the Med. Two papers were missed though. Rodolfo-Metalpa et al. Showed that a zooxanthellate coral was unaffected a levels expected this century. They also showed a significant interaction with temperature in several invertebrates, suggesting that temperature is the overriding driver..\nRodolfo-Metalpa R., Lombardi C., Cocito S., Hall-Spencer J. M. & Gambi M. C., 2010. Effects of ocean acidification and high temperatures on the bryozoan Myriapora truncata at natural CO2 vents. Marine Ecology 1-9.\nRodolfo-Metalpa R., Martin S., Ferrier-Pagès C. & Gattuso J.-P., 2010. Response of the temperate coral Cladocora caespitosa to mid- and long-term exposure to pCO2 and temperature levels projected for the 2100 AD. Biogeosciences 7:289–300.\nRodolfo-Metalpa R., Houlbrèque F., Tambutté É., Boisson F., Baggini C., Patti F. P., Jeffree R., Fine M., Foggo A., Gattuso J.-P. & Hall-Spencer J. M., 2011. Coral and mollusc resistance to ocean acidification adversely affected by warming. Nature Climate Change 1:308-312. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
617	30	30	31	30	31	In addition to Durrieu de Madron, 2011, Calvo et al., 2011 could also be cited here. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
618	30	30	33	30	33	Medium confidence should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
619	30	30	33	30	34	which the greatest relative changes doesn't mak sense. Missing a word? (UNITED STATES OF AMERICA)
620	30	30	33	30	34	This sentence ("Even the deepest.....") doesn't make sense grammatically (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
621	30	30	35	30	35	After 'rare', a couple of references could be included such as Movilla et al., 2012 (Movilla, J., Calvo, E., Pelejero, C., Coma, R., Serrano, E., Fernández-Vallejo, P., Ribes, M., 2012. Calcification reduction and recovery in native and non-native Mediterranean corals in response to ocean acidification. Journal of Experimental Marine Biology and Ecology 438, 144-153.) and Martin and Gattuso, 2009 (Martin, S., Gattuso, J.-P., 2009. Response of Mediterranean coralline algae to ocean acidification and elevated temperature. Global Change Biology 15, 2089-2100.) (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)

#	Ch	From Page	From Line	To Page	To Line	Comment
622	30	31	4	31	5	This prognostic statement about sea temperatures in Semi-Enclosed Seas is made with "very high confidence" and therefore should be included in the Executive Summary. This result contextualises "very likely" points about increasing thermal stratification and hypoxia in the ES (Page 5, Line 11). Suggest to replace "Further warming" with this more robust statement. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
623	30	31	4	31	5	very high confidence could be placed within parentheses at the end of the sentence to maximize clarity and directness of wording. (Mach, Katharine, IPCC WGII TSU)
624	30	31	12	31	12	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
625	30	31	14	31	14	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
626	30	31	14	31	14	It would be helpful to specify the mechanism leading to reduced oxygen levels. (Mach, Katharine, IPCC WGII TSU)
627	30	32	18	32	18	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
628	30	32	18	32	21	The summary terms for evidence and agreement on these lines could be placed within parentheses at the end of the respective sentences, to maximize clarity and directness of wording. (Mach, Katharine, IPCC WGII TSU)
629	30	32	26	32	26	I think the giant jellyfish species should be "Nemopilema nomurai", not "Nemopile manomurai" (Head, Erica, Fisheries and Oceans Canada)
630	30	32	49	32	53	The summary terms for evidence and agreement on line 50 could be placed within parentheses at the end of the sentence to maximize clarity and directness of wording. If possible, the timeframe for these changes should also be specified. (Mach, Katharine, IPCC WGII TSU)
631	30	32	54	0	0	I have just come back from looking at reefs in the South China Sea around Hainan. There is evidence of climate-change degradation in addition to other athropogenic activities - reference: Zhao, MX, Yu, KF, Zhang, QM, Shi, Q and Price, GJ. 2012 Long-termdecline of a fringing coral reef in the Northern South China Sea. J. Coastal Research 28, 1088-1099. (Crabbe, Michael James, University of Bedfordshire)
632	30	33	1	33	1	Is the use of "very likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
633	30	33	1	33	1	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
634	30	33	19	33	19	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
635	30	33	19	33	19	The summary terms for evidence and agreement could be placed within parentheses at the end of the sentence to maximize clarity and directness of wording. (Mach, Katharine, IPCC WGII TSU)
636	30	33	20	33	20	Is the use of "very likely" here linked to a probability? If so, it should be italicized. NOTE - this same comments applies to lines 38 and 47 of this page. (UNITED STATES OF AMERICA)
637	30	33	20	33	20	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
638	30	33	44	33	44	It would be helpful to clarify further if the "where" part of the sentence pertains only to the Bay of Bengal. (Mach, Katharine, IPCC WGII TSU)
639	30	34	7	34	7	replace "has" with "have"; 11th word from beginning of line. (Somero , George , Stanford University)
640	30	34	8	0	0	with within must be "within" (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
641	30	34	22	0	0	There is no use of uncertainty language at all in this section. (UNITED STATES OF AMERICA)
642	30	34	27	34	28	For the temperature increases described here, it would be preferable to specify the uncertainties/ranges for the estimates. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
643	30	34	35	0	41	A very interesting results that shows a rapid shift in oceanographic conditions plus a dramatic biologicval response appears in Taylor, G.T., Muller-Karger, F.E. , Thunell, R.C., Scranton, M.I. , Astor, Y., Varela, R., Troccoli Ghinagliae, L. , Lorenzoni, L., Fanning, K.A. , Hameed, S., Doherty, O. 2012. Ecosystem responses in the southern Caribbean Sea to global climate change. PNAS 109 (47) www.pnas.org/cgi/doi/10.1073/pnas.1207514109. (Anadon, Ricardo, University of Oviedo)
644	30	34	38	34	38	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
645	30	34	41	34	41	It would be preferable to specify the relevant subsections of chapters 5 and 29. (Mach, Katharine, IPCC WGII TSU)
646	30	34	43	34	52	The impact of ocean acidification on Caribbean corals is not mentioned, yet there is quite a lot of research in this area. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
647	30	34	47	34	49	Should be "Increasing sea temperatures in the Caribbean have also been implicated in the spread of disease \norganisms (Harvell et al., 2002b; Harvell et al., 1999; Harvell et al., 2004) and of some introduced species" (Head, Erica, Fisheries and Oceans Canada)
648	30	35	3	35	5	Suggested change "World wide 850 million people live within 100 km of coral reefs, and are likely to derive some \nbenefits from them (Burke et al., 2011), including food, coastal protection, cultural services and income from industries such as fishing and tourism. Similar benefits are provided to others by other coastal ecosystems (e.g. mangroves) and the offshore areas within the CBS regions." (Head, Erica, Fisheries and Oceans Canada)
649	30	35	15	35	17	For these increases, the baseline year should be specified. (Mach, Katharine, IPCC WGII TSU)
650	30	35	18	35	21	Other than extrapolation, what evidence basis supports this statement? Should it be qualified further, for example indicating the role of other stressors to date? (Mach, Katharine, IPCC WGII TSU)
651	30	35	21	35	23	A finding that includes a probabilistic measure of uncertainty does not require explicit mention of the level of confidence associated with that finding if the level of confidence is "high" or "very high". (UNITED STATES OF AMERICA)
652	30	35	27	35	28	Should it be "coral reef ecosystems as they exist today"? i.e. likely that some sort of coral reefs but with very different community makeup? (Lough, Janice, Australian Institute of Marine Science)
653	30	35	27	35	28	Does this statement apply to all coral reefs, or is there any variability in projected outcomes? (Mach, Katharine, IPCC WGII TSU)
654	30	35	32	35	35	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
655	30	35	32	35	35	These statements also supported by van Hooidonk et al. 2013 (R. van Hooidonk, J. A. Maynard, S. Planes. Temporary refugia for coral reefs in a warming world. Nature Climate Change, 2013; DOI: 10.1038/nclimate1829). (Eakin, Mark, National Oceanic and Atmospheric Administration)
656	30	36	13	36	13	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
657	30	36	13	36	13	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
658	30	36	27	36	27	agreement should also be italicized. Additionally, is it possible to also specify a summary term for evidence? (Mach, Katharine, IPCC WGII TSU)
659	30	36	31	0	0	since from must be "from" (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
660	30	36	38	36	38	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
661	30	36	41	36	41	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
662	30	37	12	37	13	Henson et al. [2010] analyse global data separated into a number of different biomes - what is the rationale for only including the study in the section on the Canary Current? Justification needed for the specific inclusion of this citation here, or else it should be included in a more general section. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)

#	Ch	From Page	From Line	To Page	To Line	Comment
663	30	37	34	37	34	Is it possible to also specify a summary term for evidence, following the guidance for authors? (Mach, Katharine, IPCC WGII TSU)
664	30	38	0	0	0	I strongly advise not to use the word “acidic”. The definition of “acidic” in the Oxford English dictionary is “having the properties of an acid; having a pH of less than 7?. Despite the process of ocean acidification (the acidity of seawater has increased 26% since preindustrial time), the oceans are alkaline (pH higher than 7) and will not become acidic in the foreseeable future. Hence, the "acid" or “acidic” should not be used when referring to seawater. Note that there are few exceptions, seawater can be acidic in the immediate vicinity of CO2 vents or in purposeful perturbation experiments, but this is not a real concern of this chapter. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
665	30	38	8	38	9	This sentence doesn't make sense - It should probably read "Fish catches from the California Current have been around 0.6 million tons/yr since 1950....". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
666	30	38	18	38	38	Peterson and Schwing (2003) demonstrate the relationship across multiple trophic levels, and the importance of changes in ecosystem structure as well as productivity due to climate variability CITATION - Peterson, W.T. and F.B. Schwing. 2003. A new climate regime in northeast Pacific ecosystems, Geophysical Research Letters 30 (17): 1896, doi:10.1029/2003GL017528. (UNITED STATES OF AMERICA)
667	30	38	30	38	33	This is a general statement that applies to more than this region. Include it in thinking about how to handle repetition through the chapter. (UNITED STATES OF AMERICA)
668	30	38	40	38	40	Evaluate level of agreement in addition to quality of evidence. For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
669	30	38	43	38	44	There appears to be a reference missing here. (UNITED STATES OF AMERICA)
670	30	38	45	38	45	Change mmol to µmol (UNITED STATES OF AMERICA)
671	30	38	48	38	48	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
672	30	38	48	38	48	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
673	30	38	50	38	53	This statement should be qualified with a confidence or likelihood statement(s) (UNITED STATES OF AMERICA)
674	30	39	28	39	31	Mendelssohn and Schwing (2002) previously showed this upwelling intensification pattern in the Humboldt Current (Peru and southern Chile), matching the trend found in the California Current. CITATION - Mendelssohn, R. and F.B. Schwing. 2002. Common and uncommon trends in SST and wind stress in the California and Peru-Chile Current Systems Progress in Oceanography 53: 141-162. (UNITED STATES OF AMERICA)
675	30	39	33	39	33	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
676	30	39	39	39	39	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
677	30	39	39	39	39	The chapter team should consider placing the summary terms for evidence and agreement within parentheses at the end of the sentence to maximize clarity and directness of wording. (Mach, Katharine, IPCC WGII TSU)
678	30	39	44	39	44	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
679	30	40	5	0	14	To discuss properly the effects os changes in fisheries could be interesting the above mentioned results of Taylor. From a theoretical point of view the references of Rykaczewski and Checkley and Pickett and Schwing could be interesting because introduce a more complete vision of upwellings (Anadon, Ricardo, University of Oviedo)
680	30	40	5	40	5	likely (Somero , George , Stanford University)
681	30	40	11	40	11	There is reference made to Figure 30-16 in this section. However, there is no such figure. (UNITED STATES OF AMERICA)
682	30	40	18	40	18	Doesn't seem like this use of "likely" should be italicized (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
683	30	40	20	40	20	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
684	30	40	20	40	20	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
685	30	40	44	40	44	The chapter team could consider placing "very likely" with the main verb of the sentence to maximize directness of wording: "have very likely expanded." (Mach, Katharine, IPCC WGII TSU)
686	30	40	46	40	46	Insert thus "Chlorophyll levels, as determined by remote-sensing of ocean colour, have decreased etc" (Head, Erica, Fisheries and Oceans Canada)
687	30	40	46	41	4	(see also executive summary on page 4, line 32-34) There are several cautions that need to be mentioned concerning the repeated claim/hypothesis that chlorophyll (and primary production) of the oceans have decreased. As pointed out in Chavez et al. (2011) and "Chapter 6 Ocean systems" the evidence for a reduction in chlorophyll and primary production is limited and conflicting. The study of Vantrepotte and Melin (2011) which is the main citation in Chapter 30 is based on SeaWifs derived chlorophyll (surface) and not on the chlorophyll of the water column (per m2) and represent a short time period. This needs to be clarified. The euphotic zone of the tropical gyres is deep and a decrease in surface chlorophyll will generally increase the depth of the euphotic zone even more (due to reduced surface shading). Hence, decrease in surface chlorophyll is not equivalent to decreased water column chlorophyll and primary production as implied in the paragraph at page 40-41 and in the executive summary at page 4. Furthermore, in their conclusions Vantrepotte and Melin (2011) warn: " Ultimately, the diversity of temporal patterns shown here (for Chla and for its relation with SST) and the rather short time period considered (10 years) caution that more work is needed to validate the proposed scenario at the scale of separate regions, particularly in the context of climate change, and to unravel how other factors perturb it." (Aksnes, Dag Lorents, University of Bergen)
688	30	41	18	41	18	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
689	30	41	19	41	19	uncertain is not one of the official confidence summary terms; please replace or remove italics (UNITED STATES OF AMERICA)
690	30	41	19	41	19	uncertain is not a calibrated term within the uncertainties guidance and thus it should not be italicized. (Mach, Katharine, IPCC WGII TSU)
691	30	41	36	41	36	moderate confidence should be "medium" (UNITED STATES OF AMERICA)
692	30	42	6	42	6	Also see: Expansion of oxygen minimum zones may reduce available habitat for tropical pelagic fishes; Lothar Stramma, Eric D. Prince, Sunke Schmidtko, Jiangang Luo, John P. Hoolihan, Martin Visbeck, Douglas W. R. Wallace, Peter Brandt & Arne K_rtzinger; Nature Climate Change 2, 33_37 (2012) doi:10.1038/nclimate1304; Received 06 June 2011 Accepted 02 November 2011 Published online 04 December 2011 (UNITED STATES OF AMERICA)
693	30	42	21	42	22	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
694	30	42	32	42	32	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
695	30	42	32	42	32	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
696	30	42	32	42	34	The broad timeframes within the sentence should be clarified. Does "these impacts" refer to observed impacts, whereas "major changes" are future projections?? (Mach, Katharine, IPCC WGII TSU)
697	30	42	37	42	37	It would be preferable to cross-reference the specific relevant sections of chapter 29. (Mach, Katharine, IPCC WGII TSU)
698	30	42	39	42	39	Suggested insertion/change "(leading to a deepening of the mixed layer in the west and a shoaling in the east)\n coincided with" (Head, Erica, Fisheries and Oceans Canada)
699	30	42	41	42	47	Suggest that this passage be condensed. It reads as a recitation of publications rather than an assessment. (UNITED STATES OF AMERICA)
700	30	42	48	41	48	Replace "climate change" with "climate variability" (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)

#	Ch	From Page	From Line	To Page	To Line	Comment
701	30	42	48	42	48	I note that Robinson et al. 2010 show a negative chlorophyll anomaly in the west, but a positive anomaly in the \nwest. So I suggest the following insertion "modest reduction in primary productivity in the west." (Head, Erica, Fisheries and Oceans Canada)
702	30	43	1	43	12	This section on Atlantic Ocean STGs is lacking the detail and rigor with which the sections on Pacific and Indian Ocean STGs was written. Specifically, supporting facts, details, and statistics on the impacts of increased temperature on coral reefs and pelagic fisheries have not been included for this section as they were in the other STG sections. This section should be expanded to include this level of detail. (UNITED STATES OF AMERICA)
703	30	43	10	43	12	This sentence ("Observations to changes.....") doesn't make sense grammatically (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
704	30	43	15	44	17	Given the global importance of the subtropical gyres I suggest that a statement from 30.5.6.2 be included in the Executive Summary. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
705	30	43	17	43	27	What does "are responsive" mean here? That they are warming as the atmosphere warms? If that's what it meant, \nwhy not say so? Also the next part of this sentence (Lines 17-19) is more-or-less repeated later in the paragraph (Lines 24-26) (Head, Erica, Fisheries and Oceans Canada)
706	30	43	17	43	27	I would suggest omitting them the first time round, so that paragraph starts (Head, Erica, Fisheries and Oceans Canada)
707	30	43	21	43	21	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
708	30	43	21	43	21	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
709	30	43	26	43	26	uncertain is not a calibrated term within the uncertainties guidance and thus it should not be italicized. (Mach, Katharine, IPCC WGII TSU)
710	30	43	29	43	31	The phrase "if a large part of recent changes have an origin in climate change." seems to be unnecessarily vague. \n How about replacing the entire sentence, and part of the next one, thus "The world's most oligotrophic ocean sub-regions are very likely to expand over the coming decades, with consequences for ecosystem services such as gas exchange, fisheries and carbon sequestration. Polovina et al. (2011) explored this issue for the North Pacific etc" (Head, Erica, Fisheries and Oceans Canada)
711	30	43	29	43	37	Yes the oligotrophic ocean will continue to expand. However, in STG, eddy activity is very important for the primary production. The eddy activity under future climate is still unclear. Such argument is needed to be addressed. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
712	30	43	31	43	37	It might be preferable to move this text to this corresponding geographic section? (Mach, Katharine, IPCC WGII TSU)
713	30	43	36	43	37	The catch in the STG only increased because the area of the STG increased. I think this point should be made more \nclearly here - thus "The total primary production and fish catch of the STG is projected to increase by 26%, although this is because the area it covers will increase by 30% (Polovina et al., 2011)." (Head, Erica, Fisheries and Oceans Canada)
714	30	43	39	43	39	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
715	30	43	44	43	44	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
716	30	43	45	43	45	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
717	30	43	45	43	45	medium to high confidence could be placed within parentheses at the end of the sentence to maximize directness of wording. (Mach, Katharine, IPCC WGII TSU)
718	30	43	48	43	48	Considering the amount of work that has been done in the N Atlantic STG, I found this section a bit short on detail \ncompared with the descriptions given for the other STGs. (Head, Erica, Fisheries and Oceans Canada)
719	30	43	48	43	48	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
720	30	44	1	44	4	It would be preferable to specify the relevant scenarios of climate change for these projections. (Mach, Katharine, IPCC WGII TSU)
721	30	44	2	0	0	Based on more recent models of future coral bleaching and mortality, annual bleaching is likely to occur much sooner. See and cite van Hooidonk et al. 2013. (Eakin, Mark, National Oceanic and Atmospheric Administration)
722	30	44	13	44	13	decreasing carbonate ion situations concentrations (Christian, James, Government of Canada)
723	30	44	15	44	15	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
724	30	44	15	44	15	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
725	30	44	17	44	20	Given that "medium confidence" is presented at the beginning and end of this sentence, the instance at the start of the sentence could be deleted to increase directness of wording. (Mach, Katharine, IPCC WGII TSU)
726	30	44	22	44	43	It may be preferable to move this material to 30.5.6.1.1, just briefly summarizing it here. (Mach, Katharine, IPCC WGII TSU)
727	30	44	32	44	32	Is this correct - that a compressed depth range will "reduce" vulnerability - surely vulnerability would be "increased"? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
728	30	44	37	44	43	This section is not well integrated with the chapter. Suggest that it be revised or removed. (UNITED STATES OF AMERICA)
729	30	44	40	44	40	Mako shark (Somero , George , Stanford University)
730	30	44	42	44	43	What does "an opportunity to participate and apply anticipate change" mean? Maybe this is what is meant "These \npredictions of species range displacements, contractions and expansions in response to anticipated changes in the oceans present both a challenge and an opportunity for the development of large-scale management strategies to preserve these valuable species." (Head, Erica, Fisheries and Oceans Canada)
731	30	44	42	44	43	This sentence is very difficult to understand. Not sure what the authors are trying to say. Please rewrite it. (UNITED STATES OF AMERICA)
732	30	44	42	44	43	This sentence ("These directional changes.....") doesn't make sense grammatically, and can be deleted (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
733	30	45	5	45	6	Suggested insertion "there is indirect evidence (medium confidence)" (Head, Erica, Fisheries and Oceans Canada)
734	30	45	16	45	18	I think this sentence is inconsistent with chapter 6, which suggests that deep sea species typically occur over huge areas as there is very little variability in conditions. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
735	30	45	22	45	23	The CO2 is not the fuel it self but the product of the fuel burning process. "The patterns … tracers and the CO2 produced after burning fossi-fuel signal …."\n\n (NETHERLANDS)
736	30	45	27	45	27	Moderate confidence should be "medium". (UNITED STATES OF AMERICA)
737	30	45	27	45	28	Do the authors mean medium confidence as opposed to moderate confidence? (UNITED STATES OF AMERICA)
738	30	45	36	45	36	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
739	30	45	36	45	37	The first line of this paragraph needs a reference. (UNITED STATES OF AMERICA)
740	30	45	37	45	37	A citation is needed for the 20% value. (UNITED STATES OF AMERICA)
741	30	45	41	45	41	5% of 20% or 5% of 100%? (Christian, James, Government of Canada)
742	30	45	42	45	42	Moderate confidence should be "medium". (UNITED STATES OF AMERICA)
743	30	45	42	45	42	moderate confidence should be "medium confidence" following the guidance for authors. (Mach, Katharine, IPCC WGII TSU)
744	30	45	45	45	45	medium confidence should be italicized for clarity. (Mach, Katharine, IPCC WGII TSU)
745	30	46	4	46	4	Awkward sentence ' oxygen concentrations will be less well oxygenated'. Please reword this sentence. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
746	30	46	4	46	4	oxygen concentrations will be less well oxygenated??? (Christian, James, Government of Canada)
747	30	46	4	46	5	Oxygen concentrations will be less well oxygenated Is this the same as "Oxygen concentrations will be lower"? If so, please use the latter! (Head, Erica, Fisheries and Oceans Canada)
748	30	46	8	46	12	In chapter 6 it cites evidence that some deep water corals can adapt to OA (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
749	30	46	9	46	12	This paragraph does not adequately summarize the effect of ocean acidification on deep-sea corals. Despite an initial report of a an initial study suggesting a large negative impact on calcification (Maier et al., 2009), recent evidence suggests little or no impact in the range of pCO2 projected for 2100.\nForm A. U. & Riebesell U., 2012. Acclimation to ocean acidification during long-term CO2 exposure in the cold-water coral Lophelia pertusa. Global Change Biology 18:843-853.\nMaier C., Hegeman J., Weinbauer M. G. & Gattuso J.-P., 2009. Calcification of the cold-water coral Lophelia pertusa under ambient and reduced pH. Biogeosciences 6:1671-1680.\nMaier C., Watremez P., Taviani M., Weinbauer M. & Gattuso J.-P., 2011. On board experiments to determine calcification rates and the effect of ocean acidification on Mediterranean cold-water corals. Proceedings of the Royal Society of London. Series B: Biological Sciences 279:1716-1723.\nMaier C., Watremez P., Taviani M., Weinbauer M. G. & Gattuso J.-P., 2012. Calcification rates and the effect of ocean acidification on Mediterranean cold-water corals. Proceedings of the Royal Society of London. Series B: Biological Sciences 279:1716-1723.\nMaier C., Schubert A., Berzunza Sànchez M. M., Weinbauer M. G., Watremez P. & Gattuso J.-P., 2013. End of the century pCO2 levels do not impact net calcification in Mediterranean cold-water corals. PLoS ONE 8:e62655.\nMaier C., Bils F., Weinbauer M. G., Watremez P., Peck M. & Gattuso J.-P., 2013. Respiration of Mediterranean cold-water corals is not affected by ocean acidification as projected for the end of the century. Biogeosciences Discussions 10:7617-7640.\nJantzen C., Häussermann V., Försterra G., Laudien J., Ardelan M., Maier S. & Richter C., in press. Occurrence of a cold-water coral along natural pH gradients (Patagonia, Chile). Marine Biology\nThresher RE, Tilbrook B, Fallon S, Wilson NC, Adkins J (2011) Effects of chronic low carbonate saturation levels on the distribution, growth and skeletal chemistry of deep-sea corals and other seamount megabenthos. Mar Ecol Prog Ser 442:87-99 (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
750	30	46	15	46	24	The entire 30.5.7.2 has no reference, despite the fact that has a statement with high confidence. \n\n (NETHERLANDS)
751	30	46	18	46	21	These two sentences make the same statement. Please restructure to avoid repetition. (UNITED STATES OF AMERICA)
752	30	46	19	46	19	Is the use of "very likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
753	30	46	19	46	19	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
754	30	46	20	46	20	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
755	30	46	20	46	20	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
756	30	46	22	46	22	The statement "as with the deep sea generally" is a confusing segue. Please revise for clarity. (UNITED STATES OF AMERICA)
757	30	46	27	46	45	This is a very important section (30.5.8) and figure (Figure 30-14). However it would be helpful to include more information about how the expert assessment has been conducted. How has a degree of confidence in detection and attribution across sub-regions and processes been established? Further description of Figure 30-14 would also be helpful here to make the key messages clear to readers. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
758	30	46	29	46	32	The first three sentences in this paragraph should be condensed as they are wordy and a bit repetitive. (UNITED STATES OF AMERICA)
759	30	46	34	46	34	I think a word is missing before "Physical and chemical changes…" Perhaps, "For" or "In the case of" should be added at the beginning of this sentence? (Somero , George , Stanford University)

#	Ch	From Page	From Line	To Page	To Line	Comment
760	30	46	35	46	35	The chapter team should preferably use a level of confidence, presented within italics, in place of "extremely high" confidence. (Mach, Katharine, IPCC WGII TSU)
761	30	46	35	46	37	Please use the following to replace the beginnng of this sentence: "ecological responses also fall in the upper corner of Figure 30-14" (UNITED STATES OF AMERICA)
762	30	46	44	46	44	Whose expert assessment? Is it based on each item mentioned or some other dataset? Please clarify. (UNITED STATES OF AMERICA)
763	30	46	44	46	45	For clarity please insert "across sub-regions, as designated in Fig 30-1A, and processes" (Head, Erica, Fisheries and Oceans Canada)
764	30	46	44	46	45	Also, in Fig 30-14 there is no symbol associated with "Ocean warming" for the HLSBS region (i.e. region 1) and the \nsame symbol is associated with "Ocean warming" twice for the EBUE (i.e. region 3). Maybe one of the 3s should be a 1! Finally, I might have put the symbol indicating "Declining primary productivity" in regions 4 and 6 slightly lower on both scales, to reflect the point made in Chapter 6 executive summary "The direction, magnitude and regional differences of a change in NPP in the open ocean as well as in coastal waters have limited evidence and low agreement for a global decrease projected by 2100." (Head, Erica, Fisheries and Oceans Canada)
765	30	46	48	54	40	This whole section (but particularly the text on tourism, shipping, mitigation) seems to be poorly researched. Considerable attention needs to be paid to improving the text (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
766	30	46	50	46	50	supports numerous sectors is kind of vague.What kind of sectors? Suggest deleting this sentence as the following sentence provides an adequate introduction. (UNITED STATES OF AMERICA)
767	30	47	1	47	3	The statement that "Many climate change impacts can be avoided, reduced or delayed by mitigation" seem too broad and sweeping and should be reconsidered. In addition, this entire passage is vague and may be unnecessary or condense-able. (UNITED STATES OF AMERICA)
768	30	47	14	47	16	Coastal influences cited here are especially important to semi-enclosed seas yet are not really thoroughly addressed there. Are these issues dealt with elsewhere - e.g., Ch 5 and possibly Ch 29 - and, if so, the authors need to make the appropriate cross-references. (UNITED STATES OF AMERICA)
769	30	47	17	47	17	Please delete "dramatically". The term should not be used here in combination with "..potentially dramatically..". The "opportunities" described in the sentence are an hypothesis, to our knowledge currently there is not enough scientific evidence available to universally accept this hypothesis. (GERMANY)
770	30	47	17	47	17	Suggest also citing: Mitigating Local Causes of Ocean Acidification with Existing Laws. R. P. Kelly,M. M. Foley,W. S. Fisher, R. A. Feely,B. S. Halpern,G. G. Waldbusser, and M. R. Caldwell. Science 27 May 2011: 332 (6033), 1036-1037. [DOI:10.1126/science.1 (UNITED STATES OF AMERICA)
771	30	47	19	47	19	Suggest also citing: Mitigating Local Causes of Ocean Acidification with Existing Laws. R. P. Kelly,M. M. Foley,W. S. Fisher, R. A. Feely,B. S. Halpern,G. G. Waldbusser, and M. R. Caldwell. Science 27 May 2011: 332 (6033), 1036-1037. [DOI:10.1126/science.1203815] (UNITED STATES OF AMERICA)
772	30	47	22	48	8	Uncertainty language is needed throughout this passage. Also, it reads as fairly speculative. More distinction needs to be made about what can be said with certainty, and what knowledge gaps and potential parallels with other ecological changes (etc.) exist. (UNITED STATES OF AMERICA)
773	30	47	28	47	28	Again, a word seems to be missing: should "for" be added between"evidence" and "fundamental"? (Somero , George , Stanford University)
774	30	47	28	47	29	The accumulating evidence etc. What is this sentence supposed to mean? I showed it to a few people, and no-one could figure it out! (Head, Erica, Fisheries and Oceans Canada)

#	Ch	From Page	From Line	To Page	To Line	Comment
775	30	47	28	47	31	This sentence is not clear. Please reread carefully and revise to ensure that the authors' message is trasmitted clearly. (UNITED STATES OF AMERICA)
776	30	47	33	47	33	Change "transcend" to some other verb. As written it suggest they are immune from demands, which they are not. (UNITED STATES OF AMERICA)
777	30	47	36	47	39	Just because you are able to 'value' something doesn't mean that this is itself providing adaptation options. The sentence doesn't make sense. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
778	30	47	45	47	48	Adaptation strategies that reduce the impact of climate change on ocean ecosystems are addressed in Chapter 6, section 6.4 and should probably be referenced here. (UNITED STATES OF AMERICA)
779	30	47	45	48	8	It would be preferable to provide further citations in support of these statements. (Mach, Katharine, IPCC WGII TSU)
780	30	47	52	47	52	Change to "may provide opportunities" (UNITED STATES OF AMERICA)
781	30	47	53	47	53	Does "phytoplankton" really belong in this list for blue carbon components. Please double check. (UNITED STATES OF AMERICA)
782	30	47	53	47	53	hard to see how standing crop of phytoplankton could increase significantly (Christian, James, Government of Canada)
783	30	48	1	48	1	This seems to imply that the respiration will be subaerial. The CO2 will be available for exchange with the atmosphere but the respiration will occur in the aqueous phase. (Christian, James, Government of Canada)
784	30	48	13	49	3	Ocean acidification will certainly impact shellfish capture and aquaculture, and shoud be included here. (UNITED STATES OF AMERICA)
785	30	48	16	48	16	It could be helpful to clarify whether the estimate of kilograms of food per person is a straight average of amount caught divided by the number of people who eat fish or if it excludes fish used for fertilizer and other non-food purposes. (Mach, Katharine, IPCC WGII TSU)
786	30	48	18	48	19	Please consider replacing 'from 80 to 77 million tonnes per year' by 'from 80 million tonnes in 2006 to 77 million tonnes in 2010'.\n\n (NETHERLANDS)
787	30	48	25	48	26	Replace 'overexploitation of another 30% of fisheries' by 'overexploitation of 30% of the world's fisheries'. \n\n (NETHERLANDS)
788	30	48	28	48	36	Taken together, these statements give the misleading impression that heavily industrialised fisheries are good and small-scale fisheries are bad. Perhaps the text could be revised slightly. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
789	30	48	33	48	33	The wording of this statement should be adjusted to ensure a policy neutral formulation. (Mach, Katharine, IPCC WGII TSU)
790	30	48	36	48	36	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
791	30	48	38	48	40	In the case of small-scale fisheries (especially, where the management system is primitive), adaptive management is considered effective. This should be reflected in this document. For example, description should be revised as follows: "... achieved through adaptive management strategy by (1) introduction of simple harvest controls ... , (2) flexible modification of these controls through close monitoring, and (3) investing in the ... (see the attached paper for reference, i.e. "Expanding fisheries co-management to ecosystem-based management: A case in the Shiretoko World Natural Heritage area, Japan: Mitsutaky Makino, Hiroyuki Matsuda, Yasunori Sakurai) (JAPAN)
792	30	48	44	48	44	The third from last word in this line should be "are." (Somero , George , Stanford University)
793	30	48	44	48	50	Citation should be provided for these statements. (Mach, Katharine, IPCC WGII TSU)
794	30	48	46	48	46	Qualifiers are backwards - should use "medium" for agreement and "robust" for evidence (UNITED STATES OF AMERICA)
795	30	48	49	48	49	The authors should present evidence (i.e., citations) that gains in the higher latitudes would be short lived. What is meant by short term - Decades? (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
796	30	49	1	49	2	This statement is vague. Please substantiate and provide citations. (UNITED STATES OF AMERICA)
797	30	49	29	49	29	The text should read "tuna stocks and quotas under climate change". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
798	30	49	52	49	52	Overfishing should be added to the list of human activities pressuring coral reef fisheries. (UNITED STATES OF AMERICA)
799	30	49	53	49	53	Is the use of "very likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
800	30	49	53	49	53	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
801	30	50	5	50	5	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
802	30	50	5	50	5	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
803	30	50	12	50	19	Suggest to include adaptation options for building the resilience of coral reef fisheries (tropical Pacific) to climate change in the Executive Summary. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
804	30	50	12	50	19	What about MPAs to provide 'spill over' of eggs and larvae and therefore increase stock resilience. There is a wide literature base on this topic. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
805	30	50	33	50	33	changes future there seems to be a word missing here. (UNITED STATES OF AMERICA)
806	30	50	36	50	49	The examples shown here represent increase of the fish stock. It seems unbalanced. It is better to show some decrease examples. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
807	30	50	38	50	44	A better description of the mackerel dispute and similar European territorial disagreements is included in the Cheung et al paper [Aquatic Conservation 22(3): 368-388, 2012] (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
808	30	50	40	50	43	The text says "The Atlantic mackerel has been a shared stock between EU and Norway due to its newer historical distribution. The recent advancement of the Atlantic mackerel into the Icelandic EEZ during summer has resulted in fishing from Iceland outside internationally agreed fishing quotas". To say "newer historical distribution" in the first sentence and then "recent advancement" in the latter is somewhat confusing. Therefore in the former case it is better to specify .e.g. "during the latter part of the 20th century" instead of "newer historical". Further, the latter part of the latter sentence states "has resulted in fishing from Iceland outside internationally agreed fishing quotas". It is not correct to state that "fishing from Iceland" is outside "internationally agreed fishing quotas". There are in the case of the mackerel no "internationally accepted quotas" and while that is the case all stake holders are responsible for fishing more than recommended The suggested text or phrasing for the latter sentence is therefore "The recent advancement of the Atlantic mackerel into the Icelandic EEZ during summer has resulted in fishing substantially outside recommended fishing advice". (ICELAND)
809	30	50	41	50	41	Delete "due to its newer historical distribution" and replace with "in the past". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
810	30	50	53	50	53	Genner et al., 2010. Separated fishing impacts from responses to climate change fluctuations using a 100 year data set in the English Channel. Small fish tracked climate change; large fish species were primarily impacted by fishing pressure. Worth including?\nGenner MJ, Sims DW, Southward AJ, Budd GC, Masterson P, Mchugh M, Rendle P, Southall EJ, Wearmouth VJ, Hawkins SJ. 2010. Body size-dependent responses of a marine fish assemblage to climate change and fishing over a century-long scale. Global Change Biology 16: 517-527.\n (HAWKINS, STEPHEN, UNIVERSITY OF SOUTHAMPTON)
811	30	51	3	51	3	I suggest replacing "adaption" with "adaptation" (Somero , George , Stanford University)

#	Ch	From Page	From Line	To Page	To Line	Comment
812	30	51	6	51	6	For a useful discussion about options that a fishery can adopt in light of climate change see the recent report by Frontier Economics In the UK for Defra (http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=18016) (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
813	30	51	9	0	0	Section 30.6.2.2. The key findings of chapter 10 should be cross-referenced here, ensuring a harmonized assessment across these chapters. (Mach, Katharine, IPCC WGII TSU)
814	30	51	9	51	49	30.6.2.2.this is a nice global summary for tourism issues. However, the tourism attractions here are all coastal. The chapter name was "Open Oceans" before, is this the correct place for a summary on coastal tourism? (although it was renamed "The ocean") (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)
815	30	51	11	51	49	The tourism section does not mention many well researched topics, for example impacts of jellyfish blooms and HABs on tourism or the potential positive benefits for watersports, e.g. changes in wind and waves on sailing or surfing. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
816	30	51	34	51	34	Other forms of tourism... the whale... Confusing segue. Suggest deleting the first sentence and beginning the second sentence with "in other regions" (UNITED STATES OF AMERICA)
817	30	51	45	51	46	Not sure what is meant by "and visitors" since "challenges" is the antecedent. Missing word? This is confusing as written. (UNITED STATES OF AMERICA)
818	30	52	3	52	11	There is a much fuller (quantitative) assessment of this issue in the UK Climate Change Risk Assessment - Marine & Fisheries sector report, including future projections and estimates of cost savings. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
819	30	52	5	52	5	Insert "in" between "increase" and "economic" (Somero , George , Stanford University)
820	30	52	13	52	18	What about other shipping issues such as climate change impacts on storminess, and thus on ferry services, ports etc. There is an assessment of this issue in the UK Climate Change Risk Assessment - Marine & Fisheries sector report. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
821	30	52	21	52	40	Consider including a discussion of extraction of methane hydrates as fuel (recently done by Japanese company) (UNITED STATES OF AMERICA)
822	30	52	21	52	40	Some discussion of renewable energy (offshore wind, current, tidal) opportunities/challenges in the face of climate change should be included in this section. (UNITED STATES OF AMERICA)
823	30	52	34	52	34	Change "principle" to "principal" (UNITED STATES OF AMERICA)
824	30	52	36	52	36	Is the use of "likely" here linked to a probability? If so, it should be italicized. NOTE - this same comment applies to lines 38 and 52 of this page, lines 19, 24, 36 and 39 of page 53 and line 26-27 of page 54. (UNITED STATES OF AMERICA)
825	30	52	36	52	36	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
826	30	52	38	52	38	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
827	30	52	45	0	0	Section 30.6.3.1. Assessment in this section should be coordinated with chapter 6 and 11, ensuring harmonized treatment. (Mach, Katharine, IPCC WGII TSU)
828	30	52	47	52	47	Revise the text as "Changing patterns of disease, marine biotoxins (harmful algal blooms), water and ....." (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
829	30	52	50	52	53	It would be helpful to clarify further the logic of the interactions across these sentences. Are the "predominantly negative impacts" the impacts of disease in corals, mollusks, and other invertebrates for human populations in the low-income countries? When 1st reading the sentence, the impacts seem to be synonymous with the disease in the invertebrates, rather than implying the consequences of such disease for people. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
830	30	52	51	52	51	Include Baker-Austin et al 2013 (already in the reference list) among the studies listed. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
831	30	52	52	52	52	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
832	30	53	4	53	7	Revise the text as "enteric pathogens are correlated with heat waves, multidecadal fluctuations of ENSO....." (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
833	30	53	6	53	7	Include Baker-Austin et al 2013 (already in the reference list) among the studies listed. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
834	30	53	12	53	27	This paragraph should be moved up to the fisheries section 30.6.2.1 (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
835	30	53	19	53	19	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
836	30	53	23	50	25	I could not understand why in the western equatorial pacific has benefit with the eastward shift of tuna. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
837	30	53	24	53	24	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
838	30	53	24	53	25	Tuna is not mentioned in combination with the Pacific in 30.5.1 (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)
839	30	53	30	54	10	Given the prominence of possible mitigation strategies provided by ocean systems in the Executive Summary (Page 6, Line 19), could more be said here in terms of available evidence and the uncertainity associated with these options? (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
840	30	53	36	53	36	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
841	30	53	39	53	39	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
842	30	53	39	53	40	The text seems to be very alarmist given that most CCS sites are several km below the seabed and a catastrophic release or seep of CO2 would only be expected following a major geological disaster. This is not acknowledged in the text - which gives the impression that major ecosystem consequences are a foregone conclusion. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
843	30	53	40	53	40	Suggest changing to "declining oxygen levels and changing trophic networks" (UNITED STATES OF AMERICA)
844	30	53	42	53	42	This is vague as written. Suggest rewriting to point out that CO2 is either an exception or is treated in contradictory ways (the authors' intention was not clear from reading the paragraph). (UNITED STATES OF AMERICA)
845	30	54	1	54	10	30.6.4.2 may rather concern a coastal topic? needs balancing with ch5 (Menzel, Lena, Alfred Wegener Institute for Polar and Marine Research)

#	Ch	From Page	From Line	To Page	To Line	Comment
846	30	54	3	54	10	The paragraph could be improved to fill charisma gap between blue and green carbon sink. \nOne could e.g. highlight the ability of mangrove, salt marsh, and seagrass to perform carbon burial in the sediment as a long-term carbon sequestration agent, as well as stress their advantages over green carbon sink.\n\nSeveral additional reference for Blue carbon sink can be mentioned, as e.g. :\n\nPidgeon, E. (2009). Carbon Sequestration by Coastal Marine Habitats: Important Missing Sinks. In Laffoley, D.d'A. & Grimsditch, G. (Ed.). (2009). The management of natural coastal carbon sinks. Gland, Switzerland: IUCN, 53 pp.\n\nPergent, G.. Romero, J., Pergent-Martini, C., Mateo, M.A., & Boudouresque, C.F. (1994). Primary production, stocks and fluxes in the Mediterranean seagrass Posidonia oceanica. Marine Ecology Progress Series, 106, 139- 146.\n\nOng, J. E. (2002). The Hidden Costs of Mangrove Services: Use of Mangroves for Shrimp Aquaculture. International Science Roundtable for the Media – 4 June 2002. Bali, Indonesia. Joint event of ICSU, IGBP, IHDP, WCRP, DIVERSITAS, START.\n\nMateo, M.A., Cebrian, J., Dunton, K., & Mutchler, T. (2006). Carbon flux in seagrass ecosystems. In W.D. Larkum, R.J. Orth, C.M. Duarte (Eds). Seagrasses: Biology, Ecology and Conservation. Springer, 567-593. \n\nMateo, M.A., Romero, J., Pérez, Littler, M.M., & Littler, D.S. (1997). Dynamics of Millenary Organic Deposits Resulting from the Growth of the Mediterranean Seagrass Posidonia oceanica. Estuarine, Coastal and Shelf Science, 44, 103-110.\n\nGranek, E.F., & Ruttenberg, B.I. (2008). Changes in biotic and abiotic processes following mangrove removal. Estuarine, Coastal & Shelf Science 80, 555-562. \n\nDuarte, C.M., Middelburg, J.J., & Caraco, N. (2005). Major role of marine vegetation on the oceanic carbon cycle. Biogeosciences, 2, 1-8.\n\nChmura, G.L., Anisfeld, S.C., Cahoon, D.R., & Lynch, J.C. (2003). Global carbon sequestration in tidal, saline wetland soils. Global Biogeochemical Cycles, 17, 1111.\n\nBouillon, S., Borges, A.V., Castañeda-Moya, E., Diele, K., Dittmar, T., Duke, N.C., Kristensen, E., Lee, S.Y., Marchand, C., Middelburg, J.J., Rivera-Monroy, V.H., Smith, T.J., & Twilley, R.R. (2008). Mangrove production and carbon sinks: a revision of global budget estimates. Global Biogeochemical Cycles, 22.\n\n (NETHERLANDS)
847	30	54	3	54	10	What about marine biofuels or offshore renewable energy? These mitigation solutions are not mentioned at all. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
848	30	54	13	0	0	Section 30.6.5. The chapter team should ensure that statements within this section are rigorously supported by the literature. If the author team asserts hypotheses beyond what is robustly supported by available evidence, these hypotheses should be appropriately qualified. (Mach, Katharine, IPCC WGII TSU)
849	30	54	17	54	17	The chapter team should be careful with the phrase "climate change related disasters," in that attributing individual events to climate change can be challenging. (Mach, Katharine, IPCC WGII TSU)
850	30	54	25	54	25	The line "people smuggling and arms and drug trafficking" should be rewritten to read "human, arms, and drug trafficking." (UNITED STATES OF AMERICA)
851	30	54	26	54	26	Casual usage of "very likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
852	30	54	26	54	27	Please remove these likelihood terms, as they are not based on quantitative evidence. (Mastrandrea, Michael, IPCC WGII TSU)
853	30	54	27	54	27	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
854	30	54	37	54	37	Greenhouse footprint is not a commonly used term. Consider changing to "carbon footprint"; Do naval activities emit other greenhouse gases (e.g., methane)? (UNITED STATES OF AMERICA)
855	30	54	40	54	40	not clear why "independence from foreign sources of energy" is relevant to this chapter (Christian, James, Government of Canada)
856	30	54	43	0	0	Section 30.6.6. For all statements in this section, the chapter team should provide line-of-sight references to the specific chapter sections supporting the findings and/or citations in the literature. (Mach, Katharine, IPCC WGII TSU)
857	30	55	19	55	19	Given the usage of a level of confidence in this statement, it would be much clearer to delete "there is little credible doubt." (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
858	30	55	19	55	20	I find this (important) statement confusing due to the two uncertainty statements used - suggest to replace "little credible doubt" with "very high confidence". (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
859	30	55	21	55	21	This statement is potentially prescriptive, and wording should be considered. (Mach, Katharine, IPCC WGII TSU)
860	30	55	23	55	24	Wording here should be considered to avoid a prescriptive formulation. (Mach, Katharine, IPCC WGII TSU)
861	30	56	4	56	4	Suggest changing "significant" to "important" and reserve significance for statistically-based declarations. (UNITED STATES OF AMERICA)
862	30	56	4	56	32	There are many existing international conventions and agreements that explicitly recognise climate change and are not mentioned here e.g. the UN Straddling Stocks Agreement, aimed at enhancing the cooperative management of fisheries resources . – There is both explicit mention of climate change and implicit understanding that management needs to viewed from perspective of the prevailing environmental conditions. Under Article 6, States are required to take into account “existing and predicted oceanic, environmental and socio-economic conditions”; in Annex 1, Article 3 - States are required to conduct “research on environmental factors affecting stock abundance, and oceanographic and ecological studies”. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
863	30	56	8	0	0	It should be stressed that there are several Regional Fisheries Management Organization/Bodies, which have responsibility of management and conservation of living marine resources on the high seas. For example, after 'commons' on the L.8 of P.56, add the words as follows: ", while recognizing several Regional Fisheries Management Organizations/Bodies which are responsible for management and conservation of living marine resources on the high seas" (JAPAN)
864	30	56	35	0	0	Section 30.7: Sections 30.7.1 and 30.7.2 confusingly overlap with the executive summary, and I would recommend that material that overlaps be deleted here, ensuring that the executive summary presents the major conclusions of the chapter. For any material retained, please ensure clear line of sight to other chapter sections where this material is discussed, and consistent usage of calibrated uncertainty language. Conclusions of the chapter should not be presented here without such language. (Mastrandrea, Michael, IPCC WGII TSU)
865	30	56	40	56	41	The importance of "rates of change" in ocean variables and the impact of this on ocean ecosystems is clearly expressed here yet is missing from the Executive Summary (aside from with reference to Ocean Acidification). I suggest to include this point as made in 30.7. (Kentarchos, Anastasios, European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)
866	30	56	40	56	41	This overarching finding could be more specific. What does "fundamental" mean, and how does the assertion differ across different levels of climate change and time frames? (Mach, Katharine, IPCC WGII TSU)
867	30	56	41	56	41	This statement is probably only true (at the "virtually certain" level) for high-emission scenarios. It probably will happen, but it is scenario-dependent. (Christian, James, Government of Canada)
868	30	56	44	0	0	Section 30.7.1. For all key findings in this section, the chapter team should ensure that it provides line-of-sight references to the supporting chapter sections. For projections given, the relevant levels of climate change and time frames (near-term versus long-term, for example) should be specified as much as possible, enhancing the nuance of these statements. (Mach, Katharine, IPCC WGII TSU)
869	30	56	46	56	46	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. (UNITED STATES OF AMERICA)
870	30	56	47	56	47	What is "the Earth Ocean"? Do you mean "Earth's Ocean" - which is anyway a pretty weird combination. How \nabout "world's oceans"? (Head, Erica, Fisheries and Oceans Canada)
871	30	56	47	56	47	The term 'Earth Ocean' is a little odd, suggest rephrasing to the 'Earth's oceans' or 'global oceans'. (AUSTRALIA)

#	Ch	From Page	From Line	To Page	To Line	Comment
872	30	56	49	56	49	thousands to millions of years I would say millions to tens of millions. (Christian, James, Government of Canada)
873	30	57	4	57	4	It would be helpful to clarify what is meant by "ecosystem assemblages that have no recent analog"--recent on what timescale? (Mach, Katharine, IPCC WGII TSU)
874	30	57	8	57	8	The phrase "serious ramifications" is not particularly clear--is it possible to indicate more precisely what is meant? (Mach, Katharine, IPCC WGII TSU)
875	30	57	9	57	11	The paragraph 30.7.1 Major Conclusions (see also executive summary page 5, line 8-15) says " In several of the world's semi-enclosed oceans (Baltic, Black, and Mediterranean Seas), ocean warming is leading to greater water column stability, which in turn has reduced mixing and primary productivity, leading to increased hypoxia at depth." Concerning these three semi-enclosed oceans I was not able to find, in chapter 30, the observational evidence for this proposed mechanism. This suggestion also appears counterintuitive in several aspects. First, isn't oxygen transported to depth in the Mediterranean Sea as a result of local deep water formation by sinking dense water due to increased salinity because of heating of the surface layer? Shouldn't we then expect more oxygen transport to depth with more warming? Second, wouldn't reduced primary production cause less sedimentation of organic material to the depth and thereby reduced respiration/oxygen consumption in the basin waters of these enclosed Seas. Third, a decrease in the primary production of the surface water causes deepening of the euphotic zone, deeper primary production, and so also of the associated oxygen production. My main concern, however, is that the statement appears to be based on a general hypothesis rather than specific observations for the areas considered. (Aksnes, Dag Lorents, University of Bergen)
876	30	57	14	57	16	Wording here could be adjusted to avoid a prescriptive formulation. (Mach, Katharine, IPCC WGII TSU)
877	30	57	18	57	23	Line-of-sight references should be provided for these statements. (Mach, Katharine, IPCC WGII TSU)
878	30	57	30	57	30	Is it possible to indicate more precisely what is meant by "fundamental changes"? (Mach, Katharine, IPCC WGII TSU)
879	30	57	30	57	32	Fundamental changes... composition of plankton communities... key fisheries. Where is this shown? It is unclear as to what 30.14B refers to. It is uncertain that the composition of plankton communities affecting fisheries has been attributed to acidification. Some revision is necessary, but the meaning is unclear so it is difficult to recommend an edit. (UNITED STATES OF AMERICA)
880	30	57	30	57	32	This is a very far-reaching statement and not substantiated to my knowledge. Data reference is unclear. There is no section 30.14 or Figure 30.14B. Figure 30.14 is the expert-elicitation exercise. I have participated in such exercises where the consensus is that such ecosystem reorganizations are likely to happen in the fairly near future, but that's different from saying that there is strong evidence that such changes are already occurring. (Christian, James, Government of Canada)
881	30	57	35	57	35	At the end of this paragraph should there be a mention of the widespread ongoing over-fishing that is probably \ncurrently a greater threat to fish populations than climate change, and that will exacerbate the effects of the latter in future? (Head, Erica, Fisheries and Oceans Canada)
882	30	57	39	57	39	Is the use of "likely" here linked to a probability? If so, it should be italicized. (UNITED STATES OF AMERICA)
883	30	57	39	57	39	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
884	30	57	45	57	52	Line-of-sight references must be provided for these statements. (Mach, Katharine, IPCC WGII TSU)
885	30	58	1	0	0	Section 30.7.2. The chapter team should strongly consider deleting this section. If retained, all statements must be directly supported by assessment in previous sections, with line-of-sight references provided to indicate the traceable account for each statement. Additionally, the chapter team should ensure that ambiguous value judgments that overstep the mandate of the chapter are avoided. To do so, terminology such as "concern" and "serious" should be deleted, with calibrated uncertainty language used instead. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
886	30	58	1	58	50	The Emerging Themes section is a really interesting and useful section. It is well written and provides a good overview of some new areas of importance. This would be a useful section to include in all chapters (AUSTRALIA)
887	30	58	3	58	3	Change "world oceans" to "world's oceans" (Head, Erica, Fisheries and Oceans Canada)
888	30	58	5	58	7	Line-of-sight references and calibrated uncertainty language are especially needed for this statement. (Mach, Katharine, IPCC WGII TSU)
889	30	58	9	58	9	Please define what is meant by 'ocean core'? (AUSTRALIA)
890	30	58	11	58	11	This should be "temperature influences on the rate of" (i.e. omit the ratio) (Head, Erica, Fisheries and Oceans Canada)
891	30	58	14	58	14	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
892	30	58	17	58	19	Is the oceans' ability to maintain O2 in the atmosphere really an issue? If so, please provide supporting references. (UNITED STATES OF AMERICA)
893	30	58	18	58	19	Not clear how any plausible climate change scenario could appreciably change the oxygen content of the atmosphere. (Christian, James, Government of Canada)
894	30	58	29	58	29	Is "robust" being used her as an official confidence statement? If so, it should be italicized and accompanied by a statement about the degree of agreement. (UNITED STATES OF AMERICA)
895	30	58	30	58	30	Revise to "years and that some organisms experience negative impacts from this change." It's important to show the relevance to ecosystems after the setup at the beginning of the paragraph (UNITED STATES OF AMERICA)
896	30	58	31	0	0	I wonder whether the citations of Hogh-Guldberg and Raven are the best ones. Consider:\nCaldeira K. & Wickett M. E., 2003. Anthropogenic carbon and ocean pH. Nature 425:365.\nZeebe R. E. & Ridgwell A., 2011. Past changes of ocean carbonate chemistry. In: Gattuso J.-P. & Hansson L. (Eds.), Ocean acidification, pp. 21-40. Oxford: Oxford University Press. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
897	30	58	32	58	36	These statements should be harmonized with assessment in chapter 6 and 5, with cross-reference provided here. (Mach, Katharine, IPCC WGII TSU)
898	30	58	38	58	38	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
899	30	58	38	58	50	It seems better to add biological feedback to CO2 absorption. If the primary production decreases, the CO2 absorption by Ocean will decrease and accelerate the warming. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
900	30	58	42	58	50	I am uncomfortable with the "certainty" expressed here that primary production has decreased in the major ocean \nbasins in light of conflicting satellite-based and in situ observations, and the fact that the executive summary of Chapter 6 expresses uncertainty about whether there will be an increase or decrease in NPP by 2100. I would rewrite things thus (Head, Erica, Fisheries and Oceans Canada)
901	30	58	42	58	50	While productivity in the major ocean basins has been reported to have decreased (satellite-based observations) \nor increased (based on in situ observations) in recent decades, it is highly likely that it will decrease in future over the longer term. Recent and future changes need to be considered in the light of natural climate variability such as ENSO, PDO and NAO, however, and it is necessary that we develop a greater understanding of the potential implications of changes that may occur over both the short and long term. Decreased primary production will lead to a reduction in ocean services with potentially serious consequences in the coming decades and century. In combination with changes to sea temperature etc (Head, Erica, Fisheries and Oceans Canada)
902	30	58	42	58	50	In Line 50 I would replace "current changes" with "recent and ongoing changes" (Head, Erica, Fisheries and Oceans Canada)

#	Ch	From Page	From Line	To Page	To Line	Comment
903	30	59	0	59	0	This section could be more specific about research and data gaps. It is hard from the current text to prioritize data needs. See Himli (2012) et al. for a review of knowledge gaps preventing economists from estimating welfare impacts of ocean acidification.\nHilmi, Nathalie, et al. "Towards improved socio-economic assessments of ocean acidification impacts." Marine Biology (2012): 1-15. (UNITED STATES OF AMERICA)
904	30	59	1	59	54	We may be able to consider about change of the current state. However, it is nearly impossible to project new species emergence in the future. This is very big issue for us. It seems better to denote about it. (Ito, Shin-ichi, Fisheries Research Agency, Tohoku National Fisheries Research Institute)
905	30	59	6	59	7	Suggested replacement "comprehensive measurements of many parameters have only been available for the past \n50 years or less, and then only for some ocean regions." (Head, Erica, Fisheries and Oceans Canada)
906	30	59	7	59	7	This statement should be reworded to avoid a prescriptive formulation. (Mach, Katharine, IPCC WGII TSU)
907	30	59	8	59	8	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
908	30	59	14	59	16	Suggested replacement "ocean basins is especially important given the significant influence of short-term natural \nclimate variability (e.g. ENSO, PDO, AMO) that is superimposed on the long-term trends. Understanding how the variability that key fisheries currently face will be affected by ocean warming and acidification presents another important knowledge and research gap. " (Head, Erica, Fisheries and Oceans Canada)
909	30	59	18	59	18	Replace "abundant" with "extensive" (Head, Erica, Fisheries and Oceans Canada)
910	30	59	18	59	18	Change "most abundant" to "largest". Abundance implies bounty. (UNITED STATES OF AMERICA)
911	30	59	20	59	20	What are the "non-climate change factors" that are impacting, or might impact, the deep ocean? I didn't see \nanything in the section on "Deep Sea" that started on Page 44 that would fit the bill. (Head, Erica, Fisheries and Oceans Canada)
912	30	59	29	59	29	Replace "copepods" with "zooplankton" (Head, Erica, Fisheries and Oceans Canada)
913	30	59	31	59	31	Most of the cnidarians studied are free swimming, not benthic, so omit "cnidarians", or "benthic", or replace \ncnidarians with some other much studied benthic invertebrate. (Head, Erica, Fisheries and Oceans Canada)
914	30	59	35	59	35	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
915	30	59	36	59	37	Calibrated uncertainty language and line-of-sight references should be provided for this statement. Harmonization with chapter 6 should also be ensured. (Mach, Katharine, IPCC WGII TSU)
916	30	59	39	59	39	Wording here ("it is an imperative") should be adjusted to avoid a prescriptive formulation. (Mach, Katharine, IPCC WGII TSU)
917	30	59	48	59	48	Change thus "be applied at a scale which will help us to understand and project" (Head, Erica, Fisheries and Oceans Canada)
918	30	59	48	59	48	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Mach, Katharine, IPCC WGII TSU)
919	30	60	3	60	3	Need to make sure these FAQs have some consistency (or at least do not conflict with) those in Chapter 6 (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
920	30	60	7	60	8	These changes can be reversed if emissions are stopped. I think there are no evidences demostrating "reversed". Need to show evidence of being reversed. (MURATA, AKIHIKO, Japan Agency for Marine-Earth Science and Technology)
921	30	60	8	60	8	Replace "slower" with "more slowly" (Head, Erica, Fisheries and Oceans Canada)
922	30	60	14	0	0	This FAQ seems to have no specific link to the oceans and therefore does not seem relevant for this chapter. Suggest revising or deleting. (CANADA)
923	30	60	14	0	0	FAQ 30-2 Authors may wish to highlight other acions besides better management like managing consumption, etc. (Chatterjee, Monalisa, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
924	30	60	14	60	15	Suggested replacement "FAQ 30.2: How can we manage the effects of climate change in the ocean? Natural systems\n are exposed to a variety of stressors in addition to climate change. We need to etc" (Head, Erica, Fisheries and Oceans Canada)
925	30	60	15	60	16	Wording here should be adjusted to avoid a prescriptive formulation. (Mach, Katharine, IPCC WGII TSU)
926	30	60	22	60	24	Suggested replacement "Developing ecosystem-based management for fishery resources where climate-induced \nchanges in productivity are occurring will help maintain their sustainability." (Head, Erica, Fisheries and Oceans Canada)
927	30	60	22	60	24	This sentence ("Developing ecosystem.....") doesn't make sense grammatically (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
928	30	60	26	0	0	This FAQ should specify that the focus is on marine plants and animals (not plants and animals generally). (CANADA)
929	30	60	26	0	0	FAQ 30-3 The land /ocean comarison is good. Perhaps the question could reflect it. (Chatterjee, Monalisa, IPCC WGII TSU)
930	30	60	27	60	27	Suggested replacement "The opportunities for adaptation and accommodation to climate change etc" (Head, Erica, Fisheries and Oceans Canada)
931	30	60	38	0	0	FAQ 30-4 Authors may wish to explain marine primary productivity for the benefit of general audience. (Chatterjee, Monalisa, IPCC WGII TSU)
932	30	60	39	60	47	Check consistency with discussion in chapter 6 on productivity, as seems to anticipate a decrease, not an increase. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
933	30	60	41	60	42	Suggested replacement "Their photosynthetic activity provides approximately etc" (Head, Erica, Fisheries and Oceans Canada)
934	30	60	42	60	42	Change 'supports' by 'support' and 'influences' by 'influence' (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
935	30	60	42	60	42	Their photosynthetic activity provides approximately half the oxygen we breath. Suggest deleting this statement as it is misleading. Oxygen consumption by humans is completely insignificant at planetary scales. (UNITED STATES OF AMERICA)
936	30	60	47	60	47	Replace "in-water" with "in situ" (Head, Erica, Fisheries and Oceans Canada)
937	30	60	49	60	49	This question is not clear. Does "actual loss of life" mean extinction or local extinction or...? (Mach, Katharine, IPCC WGII TSU)
938	30	60	51	60	51	Solubility changes pO2 in a fractional sense . 14 umol/kg will only apply for O2 levels at saturation. (UNITED STATES OF AMERICA)
939	30	60	54	0	0	Is it possible to clarify the extent of loss of life a little further? It will be hard for non-experts to put this text into perspective. (CANADA)
940	30	61	3	61	3	Is this outcome expected at 2°C increase? It would be helpful to clarify this. (Mach, Katharine, IPCC WGII TSU)
941	30	61	3	61	10	This passage seems extremely technical compared to the surrounding material and probably should have been discussed elsewhere in the chapter. Too much detail for a FAQ - who is the target audience for these FAQs? As written, it is not accessible to a lay audience (or a non-expert, for that matter). (UNITED STATES OF AMERICA)
942	30	61	7	61	7	Ocean data show… (plural subject) (Somero , George , Stanford University)
943	30	61	24	61	24	Insertion thus "cultural activities (religion, tourism)" (Head, Erica, Fisheries and Oceans Canada)
944	30	61	29	61	29	Change "Occur" to "be apparent". Warming and OA were presumably already occurring but were not sensed before then. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
945	30	61	29	61	29	The text should read " the most important and pervasive environmental variables". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
946	30	61	30	61	31	This last sentence makes no sense. It should be replaced with something like "Corals are extrememly important as \necosystem engineers, providing habitat for large numbers of species (Wild et al. 2011)." (Head, Erica, Fisheries and Oceans Canada)
947	30	61	38	61	38	Reference to figure "5X" needs to be updated with the appropriate figure number. (UNITED STATES OF AMERICA)
948	30	61	43	61	43	For findings with high agreement and robust evidence, present a level of confidence or a quantified measure of uncertainty. NOTE - this comment also applies to page 62, lines 6 and 9-10. (UNITED STATES OF AMERICA)
949	30	62	12	62	12	Should be Frieler et al., 2012. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
950	30	62	22	62	46	References to figures in this section need to be updated with the appropriate figure numbers (e.g. lines 22 and 46). (UNITED STATES OF AMERICA)
951	30	64	6	66	21	This box (on ocean acidification seems unnecessary as almost everything here is included in the chapter 6 text, where it is substantially better written! (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
952	30	64	17	64	19	Box CC-OA. The definition of ocean acidification is quite confusing. We would suggest: "... the uptake of CO2 into mildly alkaline ocean results in an increase in dissolved CO2 that combined with water reduces the pH, dissolved carbonate ion and the capacity ....."\n\n (NETHERLANDS)
953	30	64	21	64	21	Change to read...WGI Table 3.2 and Figure 3.18. (UNITED STATES OF AMERICA)
954	30	64	27	64	27	Reference to figure WGII, Figure 6.28 should actually be WGI, Figure 6.28. (UNITED STATES OF AMERICA)
955	30	64	35	64	35	Kroeker et al., 2013. Work published already. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
956	30	64	36	64	37	Box CC-OA. There is a reference to a Figure X.C, that does not exist.\n\n (NETHERLANDS)
957	30	64	37	64	37	Replace "X.C" with "OA-IC" (UNITED STATES OF AMERICA)
958	30	64	40	64	43	I don't think bivalves and snails compete with seaweeds, and neither do I think they are "ecosystem builders", so\n this paragraph needs re-working. (Head, Erica, Fisheries and Oceans Canada)
959	30	64	41	64	41	Raven in press, which is this reference? Not in the list.. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
960	30	64	41	64	41	Do seaweeds really compete with snails (this is how the sentence reads). Also I'm not sure I would label marine gastropods 'snails' as this might confuse the reader (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
961	30	64	48	64	48	Should mention the possibility of potential 'bottom up' impacts through marie food-webs. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
962	30	65	35	65	35	Confidence statements should be italicized. (UNITED STATES OF AMERICA)
963	30	65	36	65	36	Add "limited evidence, medium agreement" at end of sentence. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
964	30	65	42	65	42	Add "limited evidence" at end of sentence. (UNITED STATES OF AMERICA)
965	30	65	47	65	47	Billé et al., submitted, which is this reference? Not in the list.. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
966	30	65	48	0	50	Again, we suggest different wording: "Climate geoengineering techniques based on solar radiation management will not abate ocean acidification, and, in some cases, could increase it (Williamson and Turley, 2012). (Mooney, Pat Roy, Action Group on Erosion, Technology and Concentration (ETC Group))
967	30	65	48	65	50	See the comment to (Chapter 5, Page 50, Lines 26-28) (Ryaboshapko, Alexey, Institute of Global Climate and Ecology)
968	30	66	0	0	0	Presumably, there needs to be some reference to Figure OA-1A in the preceeding text. (UNITED STATES OF AMERICA)
969	30	66	6	66	6	Also see Roberts et al (2013) [Global Change Biology, 19: 340-351.] on the interaction between metal toxicity/pollution and ocean acidification. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
970	30	66	18	66	18	Kroeker et al., 2013. Work published already. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
971	30	71	5	71	5	Add accents to authors: Simó, Sabatés (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
972	30	78	5	78	6	Remove reference since the correct one is the previous one, lines 3-4. (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
973	30	80	19	80	21	This paper is now published: Kroeker, K.J., Kordas, R.L., Crim, R., Hendriks, I.E., Ramajo, L., Singh, G.S., Duarte, C.M., Gattuso, J.-P., 2013. Impacts of ocean acidification on marine organisms: quantifying sensitivities and interaction with warming. Global Change Biology 19, 1884–1896.\n (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
974	30	86	19	86	20	Poloczanska et al., 2013, Science, which is this reference? Has it been accepted? (Pelejero, Carles, ICREA and Institut de Ciències del Mar, CSIC)
975	30	94	0	0	0	Table 30-1. As a minor point, in some entries "system" is singular and in others "systems" is used. Should the same approach be used for each? For the 8th entry, it might be helpful to indicate also that the sub-region is not shown within figure 30-1, which is implied by the chapter 28 reference but not explicitly stated. For the 2nd footnote, what are the units of fish catches used? For the 3rd footnote, it would be helpful to clarify what the "<0.5%" means. (Mach, Katharine, IPCC WGII TSU)
976	30	94	0	94	0	Table 30-1 OK but largely repeats data that is included in figure 30-1 (panel B) (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
977	30	95	0	0	0	Table 30-2 Comments - this table and its description in the text are quite confusing. There is a tremendous amount of unclear or undefined information. The methods are unclear (index of variability, how 1x1 squares results were consolidated). Columns 3 and 5 are redundant information. What does a "pink" index of variability mean, and what is the difference between a value <0.8 versus >1.2? Does this compare the two 10-year trends, the difference in the 10-year means, or some combination? This table needs to be reconsidered. (UNITED STATES OF AMERICA)

#	Ch	From Page	From Line	To Page	To Line	Comment
978	30	99	0	0	0	Table 30-4. For the estimates provided in this table, is it possible to provide the uncertainties or associated ranges for the estimates? Also, for "difference RCP 8.5-2.6" it would be helpful to clarify that these values correspond to the long term. (Mach, Katharine, IPCC WGII TSU)
979	30	103	0	0	0	Tabel 30-6 Comments - In the table caption, the symbols for sea level rise increase and decrease are incorrect, these should be up and down arrows instead of boxes. (note - this issue seems to depend on the computer/system on which the file was viewed. Not all reviewers had this problem. (UNITED STATES OF AMERICA)
980	30	103	0	0	0	Table 30-6. For these risks, the chapter team is strongly encouraged to consider indicating risks in the near-term (through the 2040s) and in the long-term (the 2nd half of the century and beyond, perhaps with focus on the end of the century). Please see table SPM.4, as its framing could be relevant here. (Mach, Katharine, IPCC WGII TSU)
981	30	106	0	0	0	Figure 30-1. As a minor point, it would be helpful to clarify the context at the start of this caption: "In this chapter, the world's non-polar oceans..." (Mach, Katharine, IPCC WGII TSU)
982	30	106	0	106	0	Figure 30-1 generally ok, but the caption refers to region "7" deep sea, but this is not included on the map. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
983	30	107	0	0	0	Figure 30-2 Comments - The caption should provide an explanation of the color legend indicating that the pink coloring indicates overalap of historical and natural conditions. (UNITED STATES OF AMERICA)
984	30	107	0	107	0	Figure 30-2: The color codes given within the three frames are very hard to discern due to their tiny size. The same criticism applies to some of the other figures, e.g., 30-3 (Somero , George , Stanford University)
985	30	107	1	107	20	The temperature record is running below any of the projections (Gray, Vincent, Climate Consultant)
986	30	108	0	0	0	Figure 30-3 contains a world map with national borders. It is suggested to use a map without borders to avoid unnecessary disputes. (CHINA)
987	30	108	0	0	0	Figure 30-3 Comment: caption has an "E" but no figure (UNITED STATES OF AMERICA)
988	30	108	0	0	0	Figure 30-3 Comments - Line 4 in the figure caption appears to reference a panel E. There is no panel E. (UNITED STATES OF AMERICA)
989	30	108	0	0	0	Figure 30-3 Comments - The legend for Figure 30-3 should mention what the positive/negative values of velocity and shift in SST mean (e.g., positive denotes poleward movement and earlier warming/later cooling). (UNITED STATES OF AMERICA)
990	30	108	0	0	0	Figure 30-3 Comments - The purple-green color scheme used for C and D is very odd and difficult to interpret. Suggest changing to a blue/red scheme (UNITED STATES OF AMERICA)
991	30	108	0	0	0	Figure 30-3. As a minor point, it could be helpful for the reader to specify how the scales for parts C and D should be interpreted in terms of positive and negative values corresponding to earlier/later timing of sea surface temperature signals. (Mach, Katharine, IPCC WGII TSU)
992	30	109	0	0	0	Figure 30-4 contains a world map with national borders. It is suggested to use a map without borders to avoid unnecessary disputes. (CHINA)

#	Ch	From Page	From Line	To Page	To Line	Comment
993	30	109	0	0	0	Figure 30-5. For part B of this figure, is it possible to distinguish further the colors used in the scale bar, so that, for example, values between 50 and 100% could be distinguished more clearly? (Mach, Katharine, IPCC WGII TSU)
994	30	110	0	0	0	Figure 30-6 Comments - Panel A. The magnitude and trends in NCEP winds do not match other prodcuts. In particualr the large decrease in wind in the equatorial Pacific does not match other records (UNITED STATES OF AMERICA)
995	30	110	0	110	0	In the caption for figure 30-6, insert the word "Surface" so it reads "Surface salinity as the percentage change from....". (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)
996	30	111	0	0	0	Figure 30-7: Remove "ppm" from the pH color-calibration bar near the center of the page (Somero , George , Stanford University)
997	30	111	0	0	0	Figure 30-7 Comments - The Arctic Ocean is completely missing in these plots. Suggest using the plots from Feely et al (2009). (UNITED STATES OF AMERICA)
998	30	111	0	0	0	Figure 30-7 Comments - What criteria were used to set the color divisions on Figure 30-7? For example, please explain why 3.3 is the only point shown on the colorbar for Figure B and seems to correspond to the transition from yellow to green. Also, it looks like the distance between 7.6-7.8 pH doesn't match that between 7.8 and 8.0. On A, remove "ppm" label next to colorbar. (UNITED STATES OF AMERICA)
999	30	111	0	0	0	These data are from OCMIP-3. It would seem better to use the more recent estimates of CMIP-5 reported by Bopp L., Resplandy L., Orr J. C., Doney S. C., Dunne J. P., Gehlen M., Halloran P., Heinze C., Ilyina T., Séférian R., Tjiputra J. & Vichi M., 2013. Multiple stressors of ocean ecosystems in the 21st century: projections with CMIP5 models. Biogeosciences Discussions 10:3627-3676. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
1000	30	112	0	0	0	Figure 30-8 Comments - In line 1 of the figure caption and in the figure title, the critical value of partial pressure of O2 needs to be changed to 60 microatm instead of 60 matm. (UNITED STATES OF AMERICA)
1001	30	114	0	0	0	Figure 30-10 Comments - What is "consistent with climate change predictions"? The nature and source of the predictions needs to be specified. More information/clarification is needed. (UNITED STATES OF AMERICA)
1002	30	116	0	0	0	Figure 30-12 Comments - In line 3 of the figure caption, there is reference to Figure 30.3. This should be Figure 30.4. Also in line 3, there is reference made to bar graphs for the period 1870-2009, however, there are no bar graphs. In line 11 of the figure caption, there is reference made to Figure 30.4, and this should be figure 30.3. (UNITED STATES OF AMERICA)
1003	30	116	0	0	0	Figure 30-12: Black lines depicting historic values are mostly invisible for many of charts. Please provide y-axis title. (Estrada, Yuka, IPCC WGII TSU)
1004	30	116	0	0	0	Figure 30-12. Within the caption, it would be helpful to more clearly distinguish parts A, B, and C of the figure. Additionally, the bar graphs within each panel should be darkened to make them more visible, as they are currently somewhat hard to see. (Mach, Katharine, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
1005	30	117	0	0	0	Figur 30-13 Comments - In lines 2 and 3 of the figure caption, panel B should be switched with panel C. (UNITED STATES OF AMERICA)
1006	30	117	0	0	0	Figure 30-13. It would be helpful to clarify labeling across the panels so that each graph in parts B and C could be more clearly associated with a region in part A. (Mach, Katharine, IPCC WGII TSU)
1007	30	118	0	0	0	Figure 30-14 Comments - Text should be added to the figure caption stating that the numbers on the graph points indicate subregion (presumably) and matching the numbers to regions. Also, the axes should indicate direction of increasing confidence. (UNITED STATES OF AMERICA)
1008	30	118	0	0	0	Figure 30-14 Comments - The Y-axis is degree of confidence in detection and attribution, while the X is degree of confidence in detection only? Please explain more how the two measures are determined separately. (UNITED STATES OF AMERICA)
1009	30	118	0	0	0	Section 30.5.8 addresses detection and attribution in a very short paragraph referencing Figure 30-14 - though it completely lacks confidence statements (despite being in the title of the section). These messages should also be referenced against Table 18-1. The concept of this kind of figure is good, but the figure is very problematic and confusing and should be strongly considered for deletion unless there is significant modification. How can you have an axis that embeds both detection and attribution? The placement of elements on the graph is likely subjective due to the lack of consistency throughout the chapter in the use of confidence and likelihood statements that should provide the foundation for this figure. It is recommended that the author revisit this figure after standardizing and revising confidence statements throughout the chapter, perhaps include a table summarizing the confidence and likelihood assignments for the sub-regions and processes, and include appropriate scales for each of the graph axes. Also, the caption does not state what the numbers embedded in the datapoints represent. Additionally, how can Detection be embedded on the y-axis when it is the independent variable on the x-axis. Said another way, how can the amount of "D&A" be greater than the amount of "D" (e.g., for reduced calcification). Perhaps this figure would be better framed as a confidence vs. evidence figure. (UNITED STATES OF AMERICA)
1010	30	118	0	0	0	The meaning of the numbers shown in the symbols mean. Also, the levels of confidence in detection and in detection and attribution on the X and Y axes are missing. It seems to me that the degree of confidence in the detection of reduced calcification is higher than suggested in the figure and the degree of confidence in detection and attribution lower. (Gattuso, Jean-Pierre, Centre National de la Recherche Scientifique)
1011	30	118	0	0	0	Figure 30-14: The meaning of the values within the plotted shapes should be reiterated in the figure caption. (Estrada, Yuka, IPCC WGII TSU)

#	Ch	From Page	From Line	To Page	To Line	Comment
1012	30	118	0	0	0	Figure 30-14. The numbers used within the symbol should be clarified explicitly within the figure caption. Presumably they refer to the different sub-regions introduced in table 30-1? The chapter team should also consider presenting a table in which chapter sections supporting each example could be identified, along with any further information key to understanding each example. Such pairing of table and figure in the context of detection and attribution can be observed, for example, in chapter 3. (Mach, Katharine, IPCC WGII TSU)
1013	30	119	0	0	0	Figure 30-15 Comments - The authors should include references to underlying sections in chapters (UNITED STATES OF AMERICA)
1014	30	119	0	0	0	Figure 30-15 Comments - The text in this figure is so small that it is difficult to read. Please make sure final figure is more legilble. (UNITED STATES OF AMERICA)
1015	30	119	0	0	0	Figure 30-15. For the key risks summarized in this figure, the chapter team should consider indicating how they differ with level of climate change and time frame, perhaps referencing the framing used for table SPM.4 within the summary for policymakers. (Mach, Katharine, IPCC WGII TSU)
1016	30	120	0	0	0	Box 30-16 Figure Caption Comments - This figure is refered to as Figure 30-16 in the text. The text needs to be updated to reflect the accurate figure numbering. (UNITED STATES OF AMERICA)
1017	30	121	0	0	0	Figure CR-1 Comments - In the figure caption, there are references to figures XB and XA. These need to be updated with the appropriate references. (UNITED STATES OF AMERICA)
1018	30	122	0	0	0	Figure OA-1 Comments - The ordering of sub-figures within this figure needs to be changed to reflect order of reference in the text. Figure B should be relabelled A, C should be relabelled B, and A should be relabelled C. Figure formatting should also be changed to reflect this ordering. Additionally, figure A is missing references to figures in the WGI report and from chapters 5, 6, and 30 of the WGII report. These need to be updated with the appropriate references. (UNITED STATES OF AMERICA)